# BALLOONS OF THE CIVIL WAR

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

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# Balloons of the Civil War

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

BALLOONS OF THE CIVIL WAR by LCDR Steven Drew Culpepper, USN, 162 pages.

This historical study investigates the military effectiveness and combat power of Civil War balloons. The categories inherent to military effectiveness include timeliness, accuracy, usefulness, operational considerations, and logistics. Limited by available material, especially those documenting Confederate efforts, this paper highlights the history of ballooning prior to the Civil War, and focuses on the Union balloon operations during the initial fall and winter of 1861-2, the Peninsular campaign, and Chancellorsville. The analysis of the measures of effectiveness from these three periods indicates the Union balloon corps amply validated its worth. War, however, is more than just a science. In this case, the "art" of warfare better explains the collapse of Thaddeus Lowe's organization after Chancellorsville. The first two modern implications of this case study involve both the unfavorable impact of personality, and the commander's influence on the assimilation of new technology. Are we better today at bringing on line the benefits associated with technology? The final point links to the concept of battle command. With the massive infusion of information available to the modern commander, are we still sending him to the lions without a whip?

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# CHAPTER 1

## INTRODUCTION

The significance of controlling the skies over a modern battlefield lies in the decisive tactical advantage that it yields to the controlling side. This ability to control and use airspace was developed through successful implementation of technology over time. Eyes gave way to field glasses to extend the range of the observer. Eventually came the transformation of electromagnetic and acoustic energy into electronic signals which facilitated electrical scanning of the battlefield. Today, advanced signal processing, which enhance the signal to noise ratio (SNR) even further, power the way to even greater detection ranges. In between these two periods came attempts to elevate the eyes of the observer.

The concept of manned flight has captivated man's thinking for centuries. It was only natural that his thoughts should turn to application of manned flight for military purposes. The shots fired on Fort Sumter in April 1861 signalling the beginning of the American Civil war, occurred sixty-eight years after the initial use of the balloon for military observation. How well did the Union

and Confederate armies bring this relatively new technology to bear?

In order to measure the effectiveness of balloons during the Civil War, the following must be assessed: timeliness, accuracy, usefulness or adequacy of the information reported by the balloonist, operational considerations, and logistics. Timeliness describes the interval of time lost between when the balloonist, or aeronaut, first witnessed an event, the commander is made aware, the commander communicates an action to a subordinate, and the subordinate responds. Accuracy can be determined from a comparison between recorded balloon reports and what the enemy was doing at that time. Usefulness or adequacy describes those events the balloonist reported that were significant to the campaign. Operational considerations describe the impact of the environment in which the balloons functioned. That is, what was the influence of topography, available daylight, and weather (including the prevailing visibility)? Finally, logistics describe the requirements of manning, maintaining and supplying the needs of the balloons.

The gain in combat power that these early observers provided to the commander can likewise be explored. According to the US Army Field Manual FM 100-5, Operations, combat power is maximized through the synergistic blend of maneuver, firepower, protection, and leadership.[1] Maneuver

describes the movement of combat forces to gain positional advantage, usually in order to deliver--or threaten delivery of--direct and indirect fires. Firepower provides destructive force; it is essential in defeating the enemy's ability and will to fight. Protection conserves the fighting potential of a force so that commanders can apply it at the decisive time and place. Leadership furnishes purpose and direction in combat which flows from a clear vision.

From a military perspective, balloons generated intelligence for the commander that was previously unavailable. The manned balloon extended the battlefield. It effectively raised the commander's eyes above the terrain, thereby permitting him to see beyond obstacles and focus on the disposition of enemy forces around him. With this new source of information, the commander might now exercise his command and control to optimize his positional advantage vis-a-vis the enemy. Security also improved with balloon use. Direct observation along existing avenues of approach greatly reduced the chance of surprise by the enemy during periods of good visibility.

The greatest limitation to the study of Civil war balloon operations stems from the mere two-year existence of the Union balloon corps and one year for Confederate activity. The technical difficulties experienced at the outset of the conflict prevented balloons from getting to

the battle of First Manassas. Some of the communications at Fredericksburg were telegraphed or shouted and never recorded. Other communications were simply lost since the balloon corps was not assigned in a regular sense to the chain of command, but rather loosely attached for administrative purposes to various other organizations within the Union army. The balloons were unable to follow the Union army to Antietem for want of wagons.[2] Primary source documents are limited to sketchy coverage of Thaddeus Sobieski Constantine Lowe's correspondence throughout the period. Confederate sources are confined to journals recorded several years after the events that occurred during the Peninsular campaign. Therefore, this paper will focus on the available material prior to and including the Peninsular and Chancellorsville campaigns in which both sides conducted offensive operations while employing their respective balloons.

## CHAPTER 2

## BACKGROUND

The Montgolfier brothers first harnessed the lifting power of hot air in Annonay, France, on 5 June 1783. The 35 foot diameter spherical balloon rose to a height of some 6,000 feet. That August, the world's first hydrogen filled balloon ascended over Paris. The man responsible, physicist J. A. C. Charles, improved upon the hot air idea by using the recent discovery of hydrogen by Henry Cavendish (1766)[1] to provide additional lift in a 12 foot diameter globe.[2] The seeds of American ballooning were planted in Benjamin Franklin who, one week prior to signing the Treaty of Paris, witnessed the Montgolfier demonstration and informed colleagues on both sides of the Atlantic as to its military implications.[3]

Man did not venture aloft until that fall when on 15 October Jean Francoise Pilatre de Rozier ascended in a 46 foot diameter hot air balloon. Rozier died during a subsequent ascent some two years later when his balloon caught fire and crashed on the French coast.[4]

The third means used to generate lift in balloons, after hot air and hydrogen, was coal gas. It made its first appearance in 1821 at the hands of the English balloonist,

Charles Green. Though heavier than hydrogen and also combustible, coal gas was available and cheap. It became the standard gas of ballooning.[5]

Hot air balloons came to America in 1784 with an ascent organized by Peter Carnes, a lawyer and tavern owner who privately built his own hot air device. In Baltimore on 24 June, a 13 year old boy by the name of Edward Warren became the first American to go aloft. The balloon was ruined the next month in an attempted manned flight by Carnes, thus ending his balloon ventures.[6] While no manned balloon flights occurred in America over the next decade, unmanned experiments flourished. A Frenchman, Jean Pierre Blanchard, reintroduced manned balloon flights to a Philadelphia crowd on 9 January 1793.[7] Two more Frenchmen, Louis Charles Guille and Eugene Robertson, performed manned flights for the crowds between 1819 and 1825.[8] Not until Robertson's flights did Americans take up manned ballooning again on their own. Five years later, Charles F. Durant went aloft in his own device having learned from his experiences with Robertson.[9] John Wise, the first of the Civil War balloonists, made his initial ascents in 1835 and some four years later introduced the ripping panel. This safety feature enabled the aeronaut upon his return to earth in windy conditions to instantaneously release the remaining gas in the balloon envelope by ripping open a side panel.[10]

European militaries wrestled with the opportunities afforded by the balloon on the one hand, along with the employment limitations of the new technology on the other. The French were the first to employ balloons in their operations at Maubeuge on 2 June 1794. Napoleon took balloons with him to Egypt, but the material was destroyed by the British fleet at Aboukir prior to them being unloaded in 1798.[11] The French disbanded their balloon corps in 1802, a ban that was to last for a quarter of a century, as internal friction mounted within their high command as to its proper application.

Other Europeans, however, followed the French lead in assimilating the balloon into their armies. The British Major John Money encouraged the use of captive balloons for military reconnaissance in his published work, A Short Treatise on the Use of Balloons and Field Observateurs in Military Operations (London, 1803). He was followed that year by the Admiralty, who proposed towing balloons from ships to spy on their rivals across the Channel, a plan that was not adopted until World War I.[12] The Danes originally envisioned their assembled balloon as a means to break the British blockade through aerial bombardment, but the project floundered and was later abandoned.[13] In 1808, the Danes successfully dropped leaflets using balloons.[14] The Russians, intent on bombing Napoleon into submission in 1812, commissioned a German, Herr Lippich, to construct a

balloon. Unfortunately for the Czar, Moscow was overrun before completion of the project.[15] However, the Russians were able to put observers aloft during the siege of Sebastopol (some 10 years later).[16]

The next resourceful military use of the balloon occurred in the siege of Venice (1849) by the Austrians, who were able to harness the balloon as a bomber. The small 19 foot diameter balloons, each carrying 30 pounds of explosives, were launched against the city only after sounding measurements located the proper launch point for the raid. These bombers produced more fear in, rather than damage on, the enemy. The air attack subsided when the wind shifted and began blowing the bombs back over Austrian lines.[17]

Innovative balloon employment continued. The first aerial photograph was taken by the Frenchman Nadar above Paris in 1858. The United States observed a similar feat in 1860, taken over Boston by William Black. Unlike their European counterparts, the U.S. military failed to capitalize on the benefits of aerial photos. Limitations imposed in the processing of film and the requirement for a stable platform were the most likely causes. While the American Photographical Society advocated the use of aerial photography to the Secretary of War, Secretary Cameron apparently took no action, nor did he respond to the Society.[18]

Prior to the 1850s, ballooning in America was limited primarily to entertainment. Two men who later competed for the top position in the aeronautic department of the Union army, John Wise and John La Mountain, set the long distance balloon record in 1859. Their balloon took off from St. Louis and landed some twenty hours later in New York, a distance of 810 miles. Later that year, Wise "officially" delivered mail from Lafayette to Crawfordsville, Indiana, although, as Mr. Gibbs-Smith in his book, A History of Flying, points out, the ultimate destination of the letters has been obscured by time.[19] By the close of the decade an estimated 8,000 people had been aloft during 3,000 ascents.[20]

The ballooning challenge in America that emerged in the 1850s was the race to cross the Atlantic. In addition to Wise and La Mountain, Thaddeus S.C. Lowe was at the forefront of this contest. Lowe's ambitious project, the *City of New York*, was completed in 1859. It's volume of 725,000 cubic feet was over nine times the size of an ordinary spherical balloon. Hydrogen supply difficulties in New York and winter storms in Philadelphia prevented Lowe from departing that year. The following summer, the balloon's envelope burst, and with it the dreams of Thaddeus Lowe.[21]

Though many ideas were discussed in the years leading to the Civil War, the military failed to capitalize

on any. The Second Seminole War (1835-42) brought with it the proposal to harness the scouting advantages of the balloon in conjunction with cavalry to help drive Indians from the Florida swamp. John Wise suggested the use of balloons as bombers in the Mexican War to destroy the Castle of San Juan de Ulua.[22] Both these ideas were rejected by the War Department.

Thus, at the start of the Civil War both sides were aware of the advantages offered by balloons with neither side boasting any experience or equipment. The Union Army tasked their Topographical Engineers to pick from the available civilian aeronauts and have them properly equipped. The race for financial supporters to cross the Atlantic transformed into a race to lead the balloon organization in the Union Army. Conversely, the Confederates initially lacked the resources to generate manned balloons for their commanders. They responded to the Union technological challenge the following year.

## Balloonists

Four aeronauts competed for service in the Union army: James Allen, John Wise, John La Mountain and Thaddeus S.C. Lowe. Often referred to as "Professors" by the media of the time, their exploits leading up to the establishment of the balloon corps were remarkable. Lowe, with his proven, reliable means to put a balloon into the air where and when it was needed coupled with his influential

government connections (up to and including President Lincoln), ultimately won this competition to lead the new organization.

James Allen was the first to fly as a Federal observer. He was born in Barrington, Rhode Island, on 11 September 1824. At the age of 33, Allen made his first ascent with Samuel A. King, a veteran aeronaut with six years experience. The partnership lasted four years. That summer of 1857, Allen conducted his first balloon solo. In the four years leading up to the war, Allen's reputation increased across the Northeast due to his frequent involvement in regional flights. He became known as "the New England Aeronaut."[23]

Allen volunteered as an aeronaut in the First Rhode Island Regiment answering Lincoln's call to arms. On April 19, Allen departed Providence for Washington. Not until 9 June did Allen make his first experimental flight in his 35 foot diameter balloon to a height reported as 5,000 feet. Difficulties with the inflation apparatus on 8 July led to a fruitless ascension attempt by Lt. Abbot, a supervisor from the Topographical Engineers. To correct for the inadequacies of this equipment, the two balloons were returned to Washington D.C. for inflation with coal gas from Alexandria. The first ruptured upon inflation. Once filled, the second balloon was transported to Falls Church. Unfortunately, gusty wind conditions impaled the balloon on

a telegraph pole.[24] On 14 July 1861, Allen's useful service to the Topographical Engineers as an independent balloonist came to an end. He went on to work for the balloon corps after it was established by Thaddeus Lowe.

John Wise of Lancaster, Pennsylvania, was born 24 February 1808. At 27, the third generation German immigrant experienced ballooning for the first time in Philadelphia on 2 May 1835, when his ground crew tossed his partially filled 28 foot diameter balloon into the air. Wise spent the duration of the flight "bouncing off the neighboring chimneys and wildly jettisoning two bags of sand ballast."[25] One year later the aeronaut had an accident while purging his balloon envelope of hydrogen. The gas caught fire and the explosion injured many onlookers while tossing him ten feet into the air. He recovered from his burns some ten days later determined to get back into the air.[26] Leading up to the Civil war, Wise enjoyed 26 years of successful demonstration flights. With this convincing background, he bore the reputation as the aeronaut of his time.[27]

Once the war broke out, Wise volunteered to lead his hometown company as its commander. He planned to serve his nation on the field of battle, not above it. He was offered an appointment as a balloonist directly from Maj. Hartman Bache, the Chief of Topographical Engineers, such was the aeronaut's reputation. Responding to inquiry, Wise informed the Army that he could build a 20,000 cubic foot balloon for

850 dollars in two weeks time. This bid enabled Wise the first opportunity in battle with the Union Army, ahead of Lowe. The balloon was built and made ready on 16 July 1861.[28]

Wise departed Lancaster and arrived in Washington two days later. Difficulties with manpower and transportation coupled with communication problems all postponed the aeronaut's departure to the field until two o'clock on the morning of the 21st. Inflated at the Columbian armory, the balloon was only half way to Manassas when the sound of battle erupted. In an attempt to hasten the effort, Major Myer, supervising for the Topographical Engineers, ordered the balloon tied to the wagon and driven to the front. As fate would have it, the balloon became wedged in some trees. Amidst a redoubled effort to extricate the silk sphere, the fabric tore, ruining Wise's chance to ascend over the battlefield.

Wise returned to Washington and readied his equipment for further service. On the 24th, Wise and his repaired balloon were airborne over Arlington. Two days later, enroute to Ball's Cross Roads, a strong breeze blew the balloon and its mooring wires against telegraph lines. Control of the balloon was lost and not regained until rifle volleys from a nearby unit interceded on Wise's behalf and brought it back to the ground. Following a rebuke for his

services as an aeronaut from Captain Whipple of the Topographical Engineers, John Wise returned to his hometown on 13 August where he resumed military service as a cavalry officer in the Pennsylvania Volunteers.[29]

Born in Troy, New York, John La Mountain's life remains a mystery prior to 1858, aside from his six ascensions with John Wise. The following year the balloonist made a sensational flight from St. Louis to Henderson, New York, by way of a Lake Erie travelling some 809 miles in the 120,000 cubic foot *Atlantic*. This distance record stood until 1910, despite Lowe's claim to the contrary. Attending La Mountain on this adventure were his financier from Vermont, Gager, and his instructor, Wise. The two balloonists went their separate ways following heated exchanges over the unceremonious water landing and subsequent loss of gear. In a second voyage out of Watertown, New York, in September of that same year, La Mountain and John Haddock, the local newspaper editor, were blown well into Canada, some 150 miles north of Ottawa. A week later and on the brink of collapse the two men were discovered by lumbermen. These two events catapulted La Mountain's reputation to new heights among the newspapers and people.[30]

La Mountain was drawn to the Union cause as a balloonist with Lincoln's call to arms, but was twice rebuffed by the Secretary of War. He received a request

from Major General Butler for his aeronautical services at Fortress Monroe, Virginia. La Mountain finally arrived on 23 July with two balloons and enough supplies to generate a supply of gas and get his operations started. Two days later he made his first ascent despite heavy winds. Weather interfered with his operations for the next five days until on the 31st, during the second ascent, La Mountain attained an altitude of some 1400 feet.[31] He concluded his successful series of flights at Fortress Monroe having exhausted his gas supplies by the 10th of August. He left by boat promising to return with a newly constructed balloon and stocks.

La Mountain reported to General Wool, General Butler's replacement, with his new 22,000 cubic foot balloon *Saratoga* only to discover the general was uninformed of his prior service. There followed a period in which La Mountain petitioned the senior leadership in Washington for service in the Union Army. La Mountain was reassigned to Brigadier General William B. Franklin's division on 27 September 1861. On 4 October the balloonist took off from Cloud's Mill to test his new method of observation, the free ascension, rising to 18,000 feet. He used the prevailing easterly winds at altitude and landed in Beltsville, Maryland. Within two weeks La Mountain was routinely conducting free ascensions over Confederate lines. Greeted by a hail of gunfire from Union troops in Louis Blenker's German Brigade

upon his return on the 18th, the balloonist recalled, "One bullet passed unpleasantly close...."[32] On 16 November the *Saratoga* was lost in a gale force wind over Confederate lines. La Mountain proceeded with the free ascents in his remaining balloon all the while attempting to gain control of one in the fleet of seven belonging to Lowe. Friction and jealousy between these two aeronauts, stemming back to their previous competitions to cross the Atlantic ocean and to head the balloon corps, continued to mount until the 19th of February. General McClellan resolved the issue by releasing John La Mountain from service, thus Lowe's balloon system won out over the lone balloonist.[33]

The final Union aeronaut, Thaddeus S. C. Lowe, was born 20 August 1832, at Jefferson Mills, New Hampshire. At the age of ten, young Thaddeus was "bound out" to a neighboring farmer when the financial drain of five children caught up with his parents. The next year he ran away to Portland, Maine, with all that he owned, eleven cents. He worked odd jobs until he saved enough to join his brother in Boston where he learned the shoemaking trade. While recovering from an illness at home in New Hampshire, he made the acquaintance of a "Professor" Dinckelhoff, a traveling chemistry performer. The "Professor" offered Lowe a position as his assistant and taught young Thaddeus many wonders of this science.[34]

Thaddeus Lowe was drawn back to ballooning, his childhood dream, at 21 years of age. He continued his studies of hydrogen and ballooning until 1856, when he had finally saved enough money to purchase his own balloon. As previously written, Lowe failed in his attempts to cross the Atlantic in his giant 130 foot diameter *City of New York;* however, through this process Lowe made the acquaintance of Professor Joseph Henry, the secretary of the Smithsonian Institution in Washington. Professor Henry persuaded Lowe to verify the easterly flow of the upper air currents without risking his life over the ocean. So in April of 1861, Lowe took his balloon to Cincinnati.[35]

On April 20th, Lowe landed aboard *Enterprise* west of Unionville, South Carolina, some nine hours after his departure from Cincinnati: a "recorded" distance of 900 miles though only 400 miles direct. Unfortunately for Lowe, his flight occurred one week after the surrender of Fort Sumter, and his reception was anything but warm. On his return trip north, Lowe was detained by the citizens of Unionville and again in Columbia as a Yankee spy. Through the help of the mayor and other educated townspeople who were familiar with the balloonist, he was released with a passport and secured his passage back to Cincinnati. It took Lowe a week to backtrack overland via the rail network to Ohio. Lowe made a final ascent on 8 May enroute to Washington to volunteer his services as a balloonist, but

unexpectedly high winds detoured him through Ontario, Canada. On the 29th, with no wind to help, he left by train for the nation's capital.[36]

Professor Henry secured for Lowe an audience with President Lincoln, who whole-heartedly endorsed the aeronaut's concept of telegraphing information to the army commander from his balloon car high above the battlefield. His ascent on 18 June 1861, demonstrated the craft's utility to the national leadership with a telegraph transmission from 500 feet aboard *Enterprise*. The ensuing publicity which surrounded the event put Lowe at the forefront for the job as Chief Aeronaut. General McDowell, through his Topographical Engineers, arranged a flight for the aeronaut in Alexandria on 22 June. The following morning Lowe ascended at Falls Church only to be hampered by strong winds. His transmissions were telegraphed to headquarters.[37]

Intense competition surrounded the selection process for military balloon service since the Topographical Engineers were shopping with a bottom line in mind. Wise beat Lowe's bid by 200 dollars for the construction of a balloon and therefore earned the first right to accompany McDowell's Army of the Potomac onto the field at Manassas.[38] Lowe waited until his opponent returned in defeat from the field before pressing his claim again. This time, with strong presidential support, he was awarded a contract to

construct a balloon and thereby earned a position in the Union army as an aeronaut.[39]

On 29 August Professor Lowe conducted the maiden flight of his 25,000 cubic foot balloon *Union* over Arlington and received his baptism of fire from Confederate artillery.[40] Throughout September Lowe conducted periodic ascents, often taking Union generals aloft with him. While the observations improved security along the Potomac from Confederate forces, Lowe provided routine field service both day and night which included inflation and movement of his balloon without incident. This security tasking was in effect his only mission, since no offensive operations were planned for some time while McClellan trained his army. Lowe's reports updated the Union generals on the progress of Confederate earthworks on the approaches to Washington. In his book, the British historian, Haydon, points out the reports were reasonably accurate when compared to Confederate reports, despite Southern attempts to deceive the Union balloonists.[41]

Lowe's introduction of mobile hydrogen gas generators was among his most significant advances to military ballooning. This innovation increased the availability of balloons to the commander at the front where they were needed. This technological leap freed the balloonist from returning to the city each time his balloon needed supplemental gas, but rather, required supplies of

acid and iron filings to be sent to the front. He adopted many forms of signals to include codes, flags, balloons, and flares. While he was aware of aerial photography, there is no evidence to support that he advanced the idea.[42] Thaddeus Lowe provided the first coordinated indirect fire in American history on 24 September 1861. He employed the telegraph and colored flags to make shot corrections from the balloon car at Fort Corcoran to General W.F. Smith's guns some three miles distant near Chain Bridge, Virginia. General Smith's directions were:

> If we fire to the right of Falls Church, let a white flag be raised in the balloon; if to the left, let it be lowered; if over, let it be stationary; if under, let it be waived occasionally.[43]

The success of the operation was indicated by General Smith leading an expedition the next day, having left orders for Lowe to observe, but that the guns were only to fire if the enemy was met. Smith's patrol was uneventful.[44] The idea of using balloons for indirect fire was tested and apparently successful, but the opportunities for future use were limited due to the lead time required to set up balloon and artillery in proximity to the target. The most fruitful use would have been siege warfare. In the east, the Confederates departed Yorktown just prior to the Federal bombardment during the Peninsular campaign.

The single balloon episode in the western theatre developed in late March 1862, with the delay imposed on General Pope by the Confederate position on Island No. 10.

John H. Steiner, Lowe's German assistant, travelled west with his balloon in early 1862 to support the war effort in that theater. After experiencing the joys associated in dealing with the military bureaucracy at Cairo, Illinois, Steiner successfully negotiated to serve with Commodore Andrew H. Foote of the Navy. On 25 March 1862, Steiner ascended with officers from Foote's flotilla, and successfully corrected their 13 inch mortar fire to enemy batteries located on the Island. Commander Walke, of the gunboat *Carondelet*, later wrote that the fire was so effective that it drove the Confederates from their batteries. This sole operation by Steiner proved to be his last as interest in using balloons out west by anyone other than McClellan was never strong.[45]

During the summer of 1861 until spring the following year, Lowe provided security to the Army of the Potomac by dispelling rumors of Confederate troop concentrations massing against Washington. Key to the endorsement of balloons in the Union Army lay in convincing the Topographical Engineers of the feasibility of balloon operations and the leadership of its usefulness. Lowe's experience constructing the *City of New York* helped him build a product that could withstand the military environment, while his travelling showman days made him the right man to sell the senior leadership. By September 20th Lowe had the support of Major General McClellan. Soon

thereafter, the Secretary of War directed the construction of four additional balloons and gas generating equipment. Professor Lowe's dream of a balloon corps was realized.[46]

## Confederate Balloon Operations

The Confederate army conducted balloon operations on a much more limited scale. While the Confederates used signal balloons along the Potomac in 1861, the only documentation that substantiated manned flights prior to the Peninsula Campaign was the balloon request from Union Brigadier General W. A. Gorman in the first winter of the war. In his request, Gorman asked for equipment similar to that of the enemy, which was opposite his.[47]

The first documented balloon use made by the Confederates came about through the efforts of a gifted young captain. E.P. Alexander resigned from West Point at the outbreak of war. A signal officer by training, he was General Beauregard's Chief of Ordnance at Manassas when the northern press began to report balloon sightings. Captain Alexander established the communication network between Confederate outposts and Southern sympathizers in Washington.[48] On 29 August 1861, Alexander had the pleasure of firing his artillery battery at T.S. Lowe as he recalled in a letter to his father, "we sent a rifle shell so near old Lowe and his balloon that he came down as fast as gravity could bring him."[49] The following spring and after

a promotion, Major Alexander brought an observation balloon made of coated cotton to the peninsula.

Captain John Randolph Bryan made the first documented Confederate ascensions during the defense of Yorktown in the Peninsula Campaign using this coated balloon. Captain Bryan, assigned to General Magruder's headquarters as his aide-de-camp, intercepted a message requesting a volunteer for General Johnston. Not knowing the volunteer would be required to ascend in a balloon, the 21 year old Bryan eagerly interviewed to Johnston's satisfaction. Bryan grew up on the peninsula and was easily able to differentiate between the various types of Union troops.[50] The young captain made three ascents in the balloon, the first two by day. During his daylight ascents, Bryan carefully sketched a map indicating streams, rivers and roads. On this sketch he, "marked the location of the enemy troops using the initial 'I' for infantry, 'C' for cavalry, 'A' for artillery, and 'W' for wagon trains."[51]

Bryan made his only night ascent immediately before Union forces attacked Yorktown. As fate would have it, the balloon's only mooring line was cut in order to free a bystander's leg which had become entangled. The line and attached leg were about to be pulled through the gears of a windlass with disastrous consequences. Bryan therefore experienced all of the perils of free ballooning that his northern contemporaries had undergone. He was mistaken for

a Union balloonist and nearly shot. Next, the balloon drifted over water and he undressed in preparation for a swim to the beach. Finally, the wind shifted and he was carried back to a friendly shore. He left the balloon, dressed, stole a horse, and finally reported his observations to General Johnston as ordered.[52] The balloon was never seen again.

The Confederates managed to build a silk balloon for the major fighting of the campaign, but it too was lost after only a week of operations. Major Alexander used the 24 foot diameter, "Silk Dress" balloon, constructed by Captain Langdon Cheves, in the Seven Days' fighting on the 27th of June. Alexander later wrote, "I saw the Battle of Gaines' Mill from it and signaled information of the movement of Slocum's division across the Chickahominy to reinforce Porter."[53] The "Silk Dress" balloon required hydrogen gas produced in the Richmond gas works, unlike all their previous balloons, which used hot air instead. With the Union army in retreat, the Confederate balloon was towed down the James river on a tug named *Teaser*. It was captured by Union forces when the boat ran aground on 4 July 1862. Thus, the Confederate offensive employment of balloons came to an end.

General Longstreet recounts his colorful version of the use of the balloon in the Confederate army efforts:

> The Federals had been using balloons in examining our positions, and we watched with anxious eyes their

> beautiful observations as they floated high up in the air, well out of range of our guns. While we were longing for the balloons that poverty denied us, a genius arose for the occasion and suggested that we send out and gather all the silk dresses in the Confederacy and make a balloon. It was done; and soon we had a great patchwork ship of many and varied hues which was ready for use in the Seven Days' campaign. We had no gas except in Richmond, and it was the custom to inflate the balloon there, tie it securely to an engine, and run it down the York River Railroad to any point at which we desired to send it up. One day it was on a steamer down the James when the tide went out and left the vessel and the balloon high and dry on a bar. The Federals gathered it in and with it the last silk dress in the Confederacy.[54]

In summary, the Confederates used two manned balloons during the Peninsular campaign with a limited degree of success in providing information to the commander. Johnston used the hot air balloon until its loss after the third ascent, while Lee used the hydrogen filled balloon until its capture after eight days of operation. The Confederates had higher priorities for their limited resources, and thus they discontinued providing their commander with this means of extending the battlefield.

## CHAPTER 3

## INITIAL BALLOON OPERATIONS

On 25 September 1861, Lowe was directed by the Secretary of War to construct four balloons and the requisite inflation apparatus. This direction propelled ballooning into a new era. But before discussing the operational episodes, let us first focus on how the balloons worked.

These four balloons, like the *Union*, were elaborately constructed. The envelope was sewn from double thick india silk by seamstresses in Philadelphia. The first balloon, *Union*, required over 1,200 yards of the fabric. The segments of fabric were reinforced at the seams, and created either a spherical or pear shaped envelope when sewn together. A valve located at the top of the envelope allowed the aeronaut to control the release of hydrogen gas. The bottom of the envelope resembled an elephants trunk which was left open to vent any excess gas pressure from within. Finally, the envelopes were treated inside and out with a varnish that made the material gas-tight. Resembling a net, cordage encompassed the envelope and came together at a ring known as a concentration hoop. A wicker balloon car was suspended from this hoop as were the guide ropes used to

raise and lower the balloon during tethered ascents. These new balloons were ready by the second week of November.[1]

Lowe's mobile generators were critical to his successful balloon operations. Unlike his competitors who tried water decomposition, Lowe borrowed from his chemistry background to find a way to produce hydrogen. His solution required the mixing of sulferic acid with iron filings. The gas generation took place in a wooden tank mounted on a standard army wagon originally built at the Washington Navy Yard. A single inflation required 3,300 pounds of iron filings mixed with ten carboys of sulferic acid, weighing another 1600 pounds. The resulting gas was hand-pumped into the envelope through a limewater washer which purged the hydrogen of impurities. The entire process took about three hours.[2]

Unlike the French military, a major hindrance to Lowe during his first year of ballooning for the army was the lack of dedicated manpower to operate his balloons. The constant requirement to train new 30 man teams of guide wire operators was a result of the ad hoc arrangement for a nearby regiment to supply the men. Regimental commanders, jealously guarding their manpower, repeatedly denied Lowe's organization of trained manpower. All told some 17 regiments furnished men to the balloon corps during the war.[3]

Balloon ascents were of two types, tethered and free. Free ascents required greater skill on the part of the aeronaut as he controlled altitude through the judicious use of sandbags and a valve that released his hydrogen. Tethered ascents required trained teams of men. Raising and lowering the balloon resembled a game of tug-of-war with seven to ten men pulling on a guide wire. These guide wires ran through pulley blocks which were fastened to trees for support. Snatch blocks were used to hold the ropes in place when the balloon arrived at the proper altitude. Windy conditions required greater vigilence on the part of the handlers. The aeronaut's recorded altitudes varied from a low of 450 feet to a maximum of 5000.[4]

Another significant innovation to military ballooning fell into the category of communications. General McClellan put a telegraph train at the disposal of the aeronautics department by late fall. This feature enabled Lowe to transmit reports from the balloon car while viewing the enemy's position. He was constrained, however, by five miles of insulated wire, and the requirement for an operator who could only be obtained from either higher headquarters or the Telegraph Corps.[5]

Other means of communication included notes and visual signals. Notes were lowered from the balloon car attached to a bullet. Once on the ground, a messanger would deliver the note to headquarters. Excepting for the work

along the Potomac River, visual signals were not extensively used. Lowe devised a scheme using long range signal flares in late 1862, but no support came in the way of funding.[6]

Once aloft, what could the aeronauts see? Ascensions took place whenever the weather permitted. The preferred times were around sunrise and sunset when smoke from the cooking fires often provided additional information to the aeronauts. Lowe carried a set of double telescopes more powerful than the issued field glasses. The longest reported observation was that of ships on the York River 30 miles distant. More common were the reports of enemy camps as reflected by the sighting of smoke from their cooking fires at distances ranging from 15 to 25 miles. Troop estimates, obtained from counting tents, required closer ranges of five to six miles.[7]

Aside from poor visibility, the wind and trees restricted the aeronaut suspended on his vantage point well above the earth. Wind often denied the aeronaut his vantage point high above the earth. On a calm day, in the smallest 30 foot diameter balloons at Lowe's disposal, 1000 feet of guide wire put the observer's eye at 1000 feet. The same balloon in a steady 20 mile per hour wind could only ascend to 707 feet, while a 46 mph wind would further limit the observer's eye to 200 feet (see appendix 1 for the math). During the Chancellorsville campaign, Lowe reported on several occasions being blown to the ground, indicating that

the dangers of the occupation were not just limited to enemy fire.

The greatest impediment to aerial observation throughout the Civil War was tree covered terrain. The following simplified geometry illustrates the limitation imposed by a 60 foot tree on direct observation from 1000 feet. The ratios of height to base are equal for two similar right triangles as depicted in Figure 1.

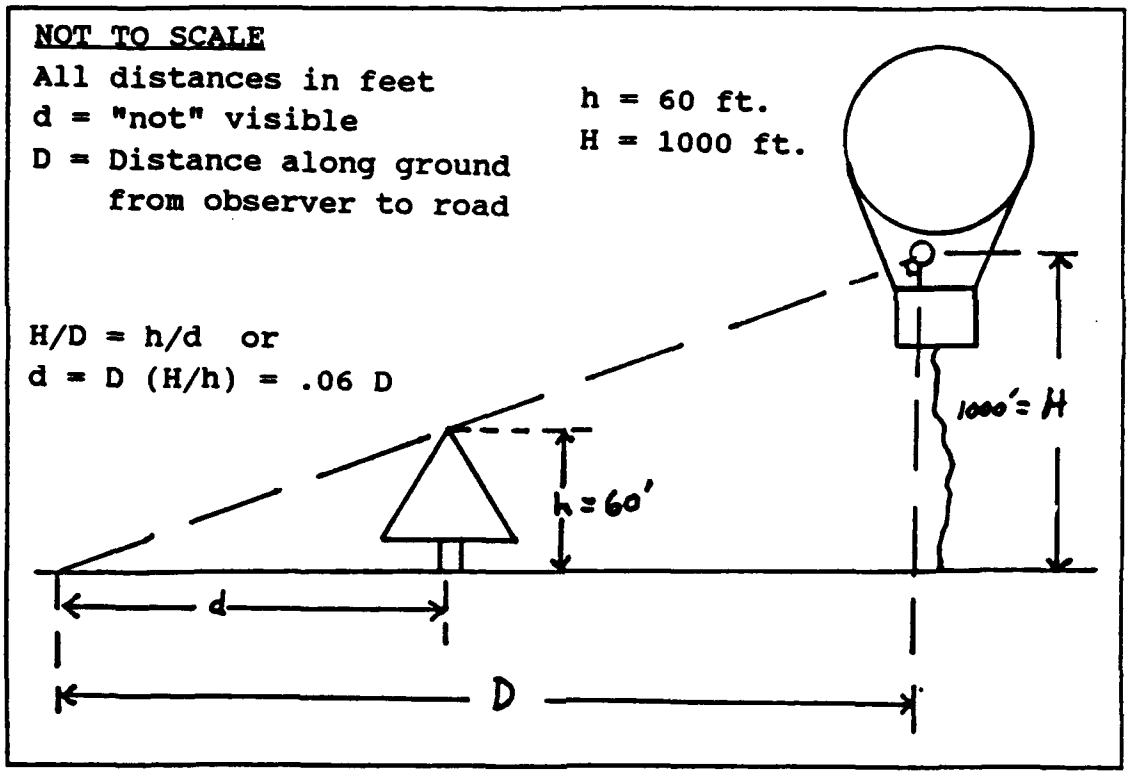


**Figure 1. Simplified line of sight geometry**

Solving for "d" in Figure 1 yields the area beyond the tree restricted from view. The key assumption to this model is

the generic 60 foot tree, through which the aeronaut could not see.

Using this basic idea, but factoring in the differences in elevation of the road under observation, the base of the tree, and the ground to which the balloon was tethered, enabled the use of a contoured map to determine those areas which were observable to an aeronaut at 1000 feet. Figure 2 depicts this more realistic geometry.

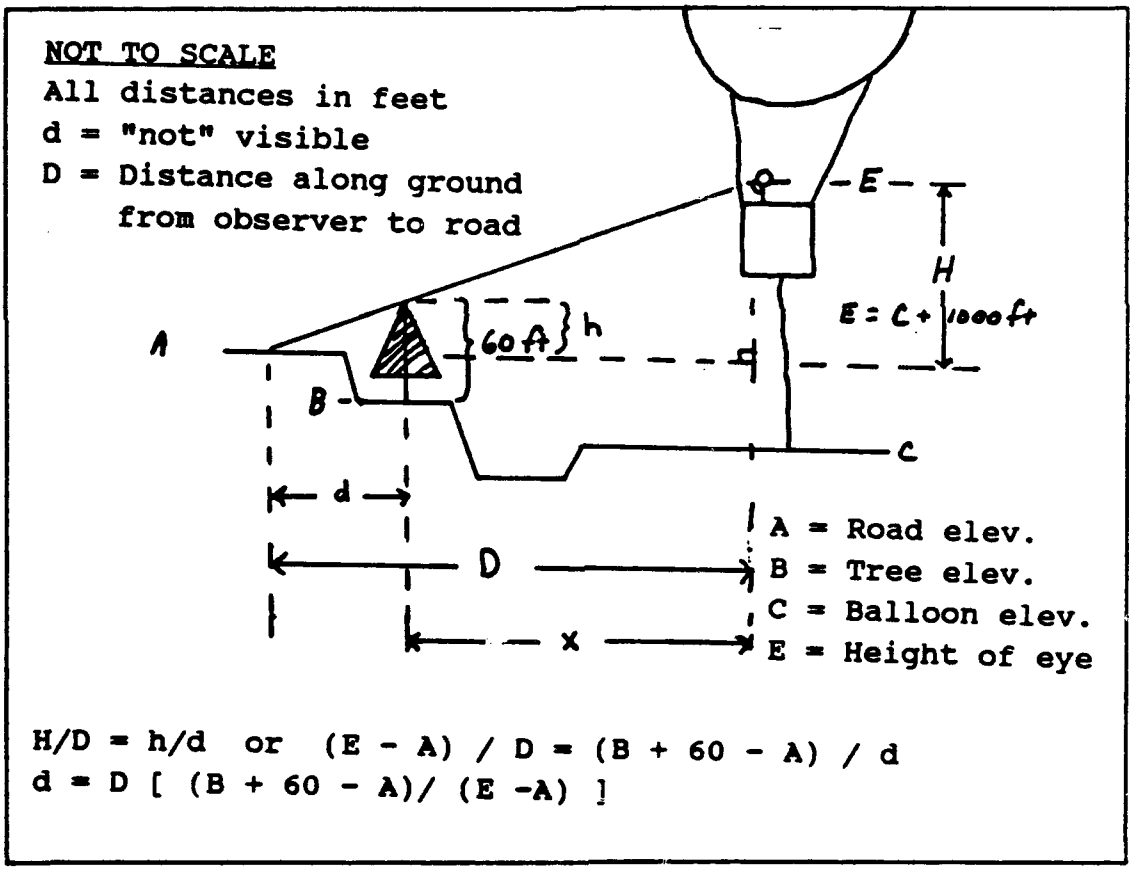


**Figure 2. Line of sight geometry**

As an example, the balloonist, 1000 feet above the ground, is looking for movement on a road 3 miles to the southwest. The road elevation is 150 feet higher than that from which the balloon is tethered. Also, a 60 foot tree with its trunk at the same elevation as the road is 500 feet along the line of sight from the road towards the observer. In this case, the tree obstructs vision for the next 1165 feet beyond, and the balloonist would be unable to see the road. This model will be used in the analysis of the Chancellorsvile campaign.

## The First Fall and Winter

Initial balloon operations took place west of the capital guarding the direct approaches to Washington. On 30 September, the sole balloon under Lowe's control, *Union*, was taken to Upton's Hill, located two miles southeast of Falls Church, Virginia, and operated extensively for a two week period by one of Lowe's assistants. Lowe, still selling the idea of ballooning, took General McDowell, the Comte de Paris, and several other officers of the staff aloft in the balloon.[8]

Lowe began yet another adventure with the direction to report with his balloon to General Smith at Johnson's Hill on 12 October. The Chief Aeronaut, with the help of mother nature, further defined the operational limitations of his new device while enroute. Lowe set out from the armory in Washington with his inflated balloon suspended

above a wagon, as the gas generating wagons were still under construction. The cordage was capable of withstanding the strain of 10 tons, but proved unequal to the task that night in the face of the gale force winds. The balloon was recovered over 100 miles away on the Delaware coast with the silk envelope intact. Lowe henceforth used stronger cordage with an increased capacity of 25 tons.[9] Following this setback, Lowe focused his energies for the remainder of the month directing the construction of balloons and generators. Figure 3 represents the initial area for balloon operations.

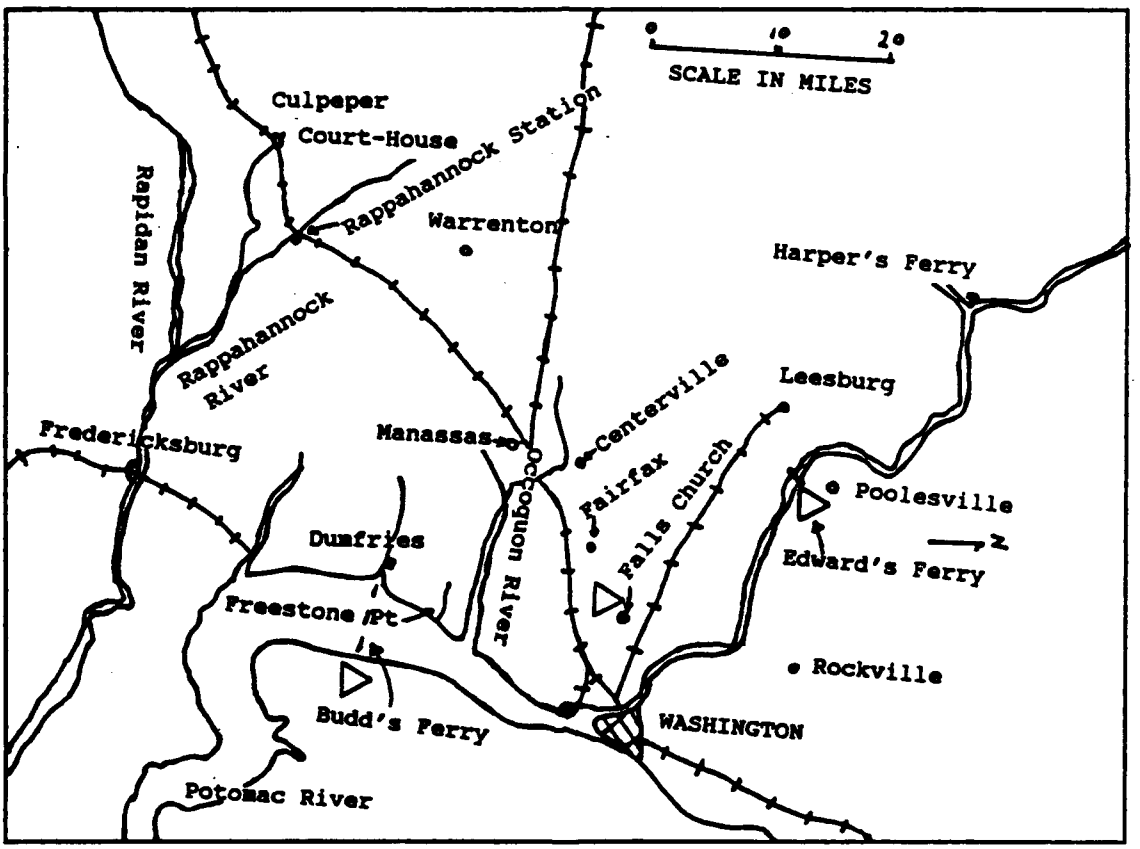


**Figure 3.** Potomac balloon operations

In late October, General Hooker, representing the Union left flank as it faced off against the Confederate army in Virginia, complained of his inability to gather information about the enemy positions opposite his command located at Budd's Ferry. He requested either a spy or a balloon. McClellan sent the latter, as construction on Lowe's new balloons was almost complete.[10]

On 10 November, Lowe reported to Major-General Hooker at the mouth of Mattawoman Creek, 20 miles south of Washington on the Potomac River, with the balloon expedition aboard U.S. Steam Tug *Coeur De Lion*. The balloon, suspended above the deck of the barge, *G.W.P. Custis*, was towed up and down the Potomac River for the next two days. This occasion marked the first successful use of Lowe's portable gas generators by the Balloon Corps in addition to complementing the security umbrella provided to the Union army.[11]

William Paullin, one of Lowe's assistants, remained behind to operate the balloon in the Chief Aeronaut's absence. Paullin's initial observations confirmed the presence of the enemy in force, determined their location, and discovered new construction on the enemy batteries at Freestone Point.[12] However, Hooker's mercurial confidence in the balloon alternated with Paullin's inability to ascend. Poor weather hampered the aeronaut. At one point, high winds compelled Paullin to release his remaining hydrogen in order to save the the envelope. Lacking any gas

supplies delayed Paullin a week while he waited for Lowe's return. Once resupplied, fog set in adding both delays to operations and frustration to General Hooker.[13]

Not until 7 December did the conditions improve allowing Paullin his opportunity to convince Hooker of the merits of balloons. Panoramic sketches drawn to scale, in addition to troop estimates which accurately reflected Confederate strengths and positions were provided by an officer from the 26th Pennsylvania Infantry, Colonel William F. Small. Small concluded that there were no more than 12,000 Confederates opposite Hooker, which he deduced from the comparison of enemy to friendly camps and tents. Haydon's research of the Official Records indicates about 10,000 Confederate soldiers were actually there. The balloon reports generated so much valuable information on the enemy positions that Hooker requested permission to attack, only to be rebuffed by McClellan who had other plans for Hooker on the Peninsula.[14]

The balloon activity proved of great concern to the Confederates opposite Hooker. General Johnston referred to repeated balloon and boat observations in his 22 February correspondence to President Davis in which he wrote of their inability to covertly reposition forces. The heavy firings of Confederate batteries on Paullin's balloon at one point had the Union General, Morrel, located twenty miles to the

north near Washington, believing that a general engagement was taking place.[15]

While Paullin floundered under the weather, Lowe spent the remainder of November positioning his new balloons and assisting aeronauts along the Potomac to the desires of General McClellan.[16] By December, the posturing of Lowe's balloons provided cover for both the direct and flank approaches to Union army guarding Washington. The balloon *Constitution* was located at Budd's Ferry with General Hooker on the southern flank. Covering the direct approaches, the *Intrepid* worked initially with General Porter's division near Hall's Hill, Virginia, but the effects of bad weather necessitated its replacement by the *Union* in January. The balloon destined for the division guarding the Union northern flank at Poolesville, Maryland, under General Stone was delayed by late construction of the portable gas generators at the navy-yard. The *Washington*, together with portable gas generators, was enroute to Port Royal, South Carolina, and would operate under General Sherman.[17]

Edward's Ferry near Poolesville, Maryland, became the operational site of the balloon on the upper Potomac. Like Hooker's balloon operations, weather frustrated attempts to keep the Confederate positions under constant surveillance. Despite this drawback, the balloon, operated initially by Ebenezer Seavor, provided security to the Union army. Seavor, often accompanied by Stone, accurately

discovered the disposition and strength of the enemy in the vicinity of Leesburg, Virginia, despite possible attempts to conceal their numbers. On the first day of ascents from Edward's Ferry, the aeronauts noted that tents seen earlier in the day had been removed. Stone estimated the Confederate strength at four regiments which favorably compares with returns of 3,000 effectives found in the Official Records.[18]

The appreciation of balloon operations was best demonstrated by the repeated requests for balloons from not only General Stone, but Generals Sedgwick and Banks as well. Sedgwick's division, operating near Stone's, requested balloon service in February, while Banks' request was forwarded the following month seeking assistance in Charleston, West Virginia.[19]

The third Union balloon operated west of the Potomac along the direct approaches to the capital with General Porter's division. Lowe made many ascensions himself from this location. He too suffered delays from the effects of weather. As was often the case at this stage of the Civil War poor intelligence indicated that the Confederates were advancing toward Washington on 21 November. Lowe's report corrected this earlier mistake and added the following:

> Judging from our own camp-fires and smokes, I should say there may be three or four regiments at Fairfax Court-House; twice that number at Centerville and more at Manassas, but nothing like the amount of smokes from our own camps in General Porter's division.[20]

The following week, Lowe reported the evacuation of Fairfax Court-House. This report was subsequently verfied by General Wadsworth's troops. The remainder of the time spent by Lowe in this sector of the Potomac was spent providing security.[21]

Lowe continued to innovate with the balloon corps. By 3 December 1861, Lowe submitted a request to build two smaller balloons which would rely on hydrogen gas from his portable generators instead of coal gas from the armory. Advantages of the new balloons included equal lift for less gas since hydrogen provided greater lift per unit volume, a reduced cross section which enabled operations in higher wind conditions, and the need for one less wagon during movement.[22] His plan was shortly thereafter approved.

Among the benefits discovered during this period of the war, draughtsmen carried aloft enabled sketches to be made of enemy positions thereby enhancing the information provided by the engineers; who were limited to only ground observation. General McClellan repeatedly ordered sketches of the Confederate positions opposite his army. He repeatedly tasked this service during the Peninsular campaign as well.[23]

Another benefit included the greatly extended range of balloon operations provided by the portable gas generators. Without these devices, Lowe's men would have had to haul each balloon from the Columbia Armory located in

Washington to the intended point of observation. Balloons would have been available only along the Potomac River or tethered by a short leash to Washington. With his new generators, Lowe was able to inflate a balloon with enough hydrogen to provide 1200 pounds of lift in only three hours.[24] He was later able to cut the inflation time in half by operating two generators in parallel as more of the devices became available.

Lowe's balloons were constructed and maintained with an eye toward the harsh environment in which they were tasked to operate. The double silk envelope, as previously mentioned, withstood the gale force winds while the rated 10 ton mooring cordage did not. The silk envelopes were given several coats of varnish which eliminated gas leaks. The balloon at Budd's Ferry operated for over two weeks without any resupply of hydrogen. The harsh winter weather took its toll on the balloons as well. General Stone requested a replacement balloon when over an inch of ice was discovered on the *Intrepid* the morning of 25 January. This balloon was rotated back to Washington for revarnishing.[25]

The aeronauts increasingly added to the intelligence available to the commander. On 10 February, the balloon operating out of Poolesville conducted ascents along the Potomac River on the roads near Edward's Ferry. Along with noting the improvements to fortifications, Confederate troops were estimated at between 10,000 to 12,000 in and

around Leesburg, Virginia.[26] This troop estimate, based upon balloon observations of enemy camps, was the first provided by Lowe in the Official Records, though he had earlier provided many more as recounted by Haydon.

General Heintzelman requested a balloon to conduct observations of Confederate positions along the Occoquon river near Pohick Church in support of Hooker's balloon already in operation at Budd's Ferry. Lowe's observations, which began on 27 February, ranged from Fairfax Station in the north to Wolf's Creek along the Occoquon in the west.

Lowe's work with General Heintzelman at Pohick Church produced the first significant sightings of impending enemy maneuver. By 7 March, the diminished enemy strength along the Occoquan coupled with increased sightings of smoke in the enemy rear were unmistakable signs of an impending Confederate withdrawel from the region. This evacuation was confirmed on the 9th with the Union taking possession of the enemy positions. With the sighting of heavy smoke from Manassas on the 6th, anticipation grew that the enemy would withdraw from that town. Lowe, delayed while enroute to Fairfax Court-House with a balloon, missed the enemy movement. However, his balloons at Pohick Church reported the huge fires around Manassas on the 10th, set by Stuart's departing rear guard cavalry.[27]

Lowe attempted aerial communications in an effort to expand his services to the army. His 11 a.m. report on 6

March noted Hooker's balloon in operation 10 miles to the south. Though Lowe directed the balloon at Budd's Ferry to transmit signals the following morning, he never indicated whether the signaling occurred or its degree of success.[28]

With the Confederate evacuation of Manassas completed, Hooker's balloon, accompanied by Seaver, was packed for transport to Fortress Monroe. Seaver reported to the commander, General Wool, with the balloon *Constitution* on 16 March 1862. His tasking required him, in addition to his general surveillance duties, to locate the ironclad *CSS Virginia*, which had recently destroyed wooden ships belonging to the Union fleet. His efforts went unrewarded with regard to locating the Confederate ironclad. Lowe, accompanying McClellan's army to the Peninsula with the remainder of the balloon corps, cut short Seaver's independent surveillance mission.[29]

By the close of March, six months after the initial order for balloons from the Secretary of War, Lowe had seven available for operations. While one balloon was sent south to Port Royal, another went west to Cairo, Illinois. Despite the contribution of Steiner's balloon in Illinois, which provided shot corrections that ultimately led to the Union success at Island number 10, these balloon operations in distant theaters from Washington withered on the vine from neglect by the local commanders.[30]

## Summary

What was the impact of Union balloons on the Confederate operations? One Federal correspondent described the Union balloons as producing "paroxysms of rage" within the Confederate ranks.[31] E.P. Alexander later wrote in his memoirs, "the balloons of the enemy forced upon us constant troublesome precautions in efforts to conceal our marches."[32]

In addition to concealing their movements, the Confederates went to great lengths to deceive the Union balloonists as to the strength of their defenses as well. Lowe, originally fooled by the threatening appearance of General Longstreet's batteries at Munson Hill, named them imitation or "Quaker guns" upon discovering the ruse. General Pierre Gustave Toutant Beaureguard issued the following instructions in September, which stressed the importance of concealment, in response to the initial Union balloon efforts:

> every precaution [must be] taken to prevent the enemy from discovering by balloons or other means the numbers of our advanced commands or outposts. No lights shall be kept at night except where absolutely necessary, and then under such screens as may conceal the lights from observation. Further, tents, if used, ought to be pitched under the cover of woods and sheltered in all cases as far as possible from accurate computation.[33]

Bearegard also advocated the use of the "Quaker guns" and the lighting of extra campfires to fool the aerial observers.[34]

Beyond these passive measures directed at the balloonists, the Confederates responded actively with their guns as well. Lincoln's biographer referred to Lowe as the most shot-at civilian in the Civil War. The Confederate artillery's inflamed response to Lowe's balloon ascents began with his first aboard *Union* in 1861, and never stopped until aerial operations ceased. E.P. Alexander's batteries would dig shallow trenches behind their positions in order to shoot at the "great gas bag professor."[35]

While the Confederate response to Lowe's balloons indicates some measure of success, there were others as well. The balloon corps under Lowe made great progress in making aerial observation available to the commander during this six month period. They had grown from one to seven balloons and constructed six portable gas generators. The nine assistant aeronauts hired by Lowe provided reliable observation along the Potomac River from Budd's to Edward's Ferry. Lowe improved the cordage after his first mishap with the wind, while varnish helped ease the strain of winter weather on the envelopes.

Lowe's balloons provided security to the Army of the Potomac throughout the first fall and winter of the Civil War. Initial reluctance on the part of generals gave way to increased demand for balloon use. The aeronauts initially observed Confederate outposts. By the end of the winter period, the level of sophistication of the observations grew

to not only provide estimates of enemy strengths, but enemy intentions as well.

Logistics, while initially a problem, was solved by Lowe as more balloons and generators came on line. Timeliness proved adequate for the set-piece defense established by McClellan to guard Washington. Weather and deception still were to prove difficult obstacles to overcome. Finally, benefits were derived by the commanders through aerial sketches as well.

All in all the balloon corps' capability had progressed beyond the teething stage and was ready to perform surveillance during offensive operations against the enemy. They would not have long to wait, as McClellan's plans were in motion to sail for the Peninsula.

# CHAPTER 4

## THE PENINSULAR CAMPAIGN

The two armies came out of the first winter of the war looking for ways to annihilate the enemy. The Union had two options in its approach to subduing the South. The first lay in the direct route to Richmond via Manassas Junction, as they had tried the previous summer. The indirect path involved transporting the Army of the Potomac south, via the water network, to some point nearer Richmond, and thence overland to the capital. The landing site was narrowed down to Fortress Monroe in mid February, after General McClellan realized that the Federal ironclad *Monitor* could hold off the Confederate ironclad *Virginia* and thereby protect his wooden transports in the vicinity of Hampton Roads.

Forming the peninsula were the York River to the north and the James River on the south. The terrain is flat with extensive forests providing overhead cover. Richmond lay 92 miles northwest of Fort Monroe. The first major Confederate obstacle between these points was their defensive line along the Warwick River and entrenchments in front of Yorktown. Water obstacles in the vicinity of Williamsburg provided the second. Except for one river

system, the remaining 56 miles to Richmond were open. The Chickahominy River flowed from the region eight miles north of Richmond and emptied into the James River 10 miles west of Williamsburg. Its tributaries and associated swamps split the peninsula down the middle and would prove to be an insurmountable obstacle to McClellan at Richmond's gate.

## Siege of Yorktown

The embarkation of McClellan's army began on 17 March 1862, while the headquarters was transferred south in the vicinity of Fort Monroe on 2 April 1862. General McDowell's 1st Corps was detached from McClellan by order of President Lincoln, who feared a Confederate attack on Washington. McClellan commanded the remaining 2nd, 3rd, and 4th Corps, led by Generals Sumner, Heintzelman, and Keyes respectively. By 3 April, McClellan had units from all three corps totaling 58,000 troops and 100 guns available. They were to march on McClellan's initial objective of the campaign, Yorktown, the next day before the Confederates could reinforce.[1]

McClellan knew little about the enemy he faced or the terrain on which he was to fight. The best information available to McClellan during the winter months placed General Magruder on the peninsula with his army of 15,000 to 20,000 men, while General Huger guarded Norfolk with another 15,000. General Johnston's army could be brought down to reinforce the Confederate troops on the peninsula as well.

Maps available at the outset were both limited and unreliable, as topographical studies had not been conducted very far from Fortress Monroe prior to the campaign.[2] The lack of maps forced McClellan to feel his way forward with armed reconnaissance as he went. Figure 4 depicts this area around Yorktown.

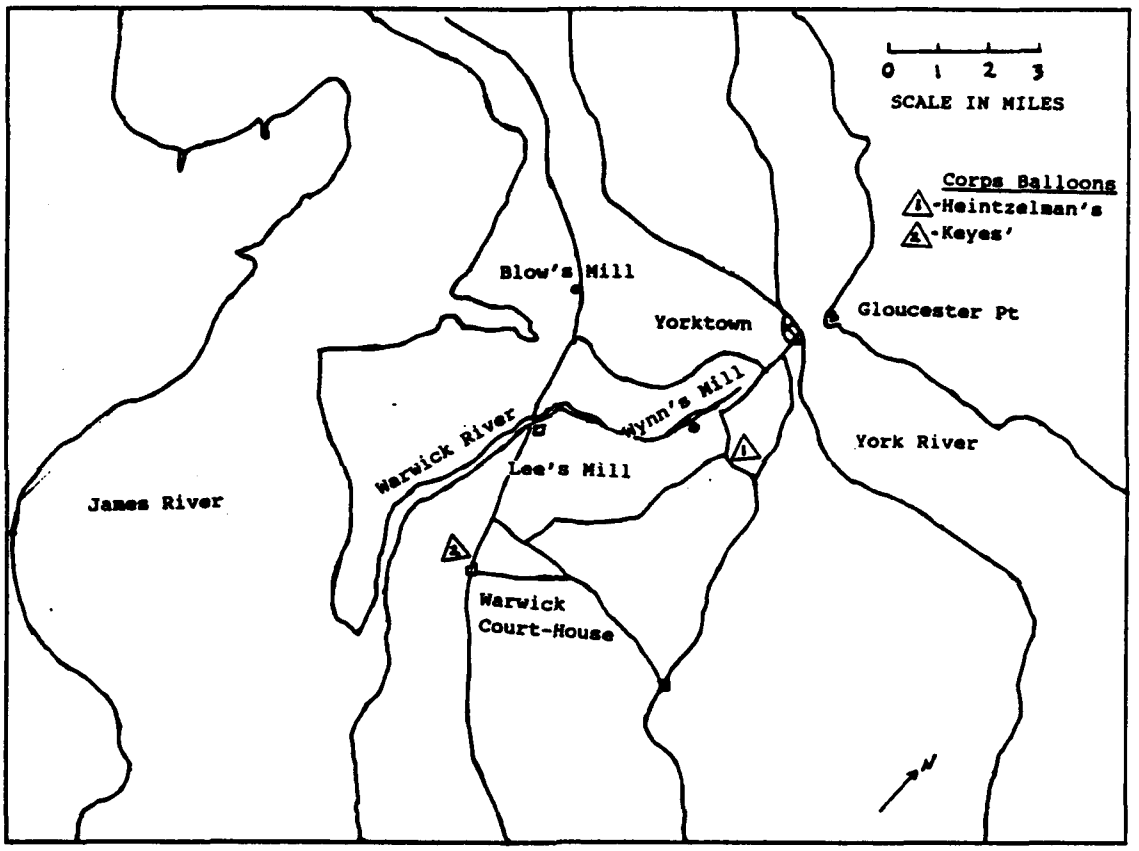


**Figure 4.** Yorktown balloon operations

McClellan became frustrated with the nautical support when he discovered the James river closed by naval authorities due to the combined presence of four Confederate steamers, including the Virginia, and numerous batteries

located along the banks. Thus his supplies were forced to flow up the York river. Additionally, ships would be unable to assist in the bombardment of Yorktown until some of the shore batteries were silenced due to the naval commitment imposed by the ironclad threat.[3]

Balloons entered the campaign on 4 April when, at the request of McClellan, Professor Lowe and his assistant, Mr. Allen, joined General Porter's division of Heintzelman's 3d Corps as it advanced on Yorktown. General Martindale's brigade was tasked to protect them.[4] Lowe's logistics train, four army wagons and two gas generators, arrived opposite Yorktown on the afternoon of the 5th. Balloon operations were delayed for over an hour due to shelling as the initial position was located within a mile of Confederate lines.

The first ascent of the campaign was made by one of Porter's staff officers with Mr. Allen at 5:30 p.m. Lowe went aloft the following morning at 3 a.m. He remained aloft until after sunrise noting the enemy's campfires and movements. Upon descending, Lowe was handed instructions from Porter which instructed the aeronaut to look for enemy wagons and troop concentrations. He went immediately to Porter and related his observations. Lowe was able to convince the general to go aloft and there he remained for the better part of two hours in order to observe the enemy and their defensive works. Following this 1000 foot

observation, Porter met with his generals to discuss the situation. Throughout the day, Porter had sketches of the enemy fortifications drawn from the balloon. Other notables that went aloft that day included the Comte de Paris and General Butterfield, Hooker's future Chief of Staff at Chancellorsville.[5]

That evening, McClellan directed Lowe to send a balloon to Keyes' 4th Corps headquarters located at Warwick Court-House eight miles away on the south side of the peninsula. While returning to Yorktown from this mission on the 11th just after sunrise, Lowe discovered General Porter falling to earth in a balloon by himself. It seems the general appreciated the early morning tethered ascents, but only one rope had been used on this occasion which had been weakened by acid. When the general discovered the predicament he was in, he quickly opened the valve which released the hydrogen gas, caused the balloon to fall, and only the silk acting as a parachute saved Porter's life.[6]

On 7 April, McClellan opted for a siege, having conducted a reconnaissance of the Confederate defensive positions along the Warwick River and Yorktown. He referred to previously attained information which led to this decision to lay siege. Balloon observations by Porter and other officers, which began on the 6th, probably influenced McClellan's decision.

Owing to Porter's recent balloon episode, other officers were reluctant to ascend. General Barnard, McClellan's chief engineer responsible for estimating the defensive strength of Yorktown, was the next officer to make, not one, but three ascents with Lowe on the 14th to study the Confederate defenses. From 15 April until 3 May the balloons were constantly in use by Professor Lowe and staff officers working for McClellan, Keyes, Heintzelman, and Porter. Verbal reports were given in most cases; regrettably few are available in the Official Records.[7] In addition to the Union balloon efforts, the second half of April witnessed the first two ascents by Confederate Captain Bryan in his hot air device.[8]

The Confederates obviously were annoyed by the Union balloons and attempted to deceive them. General Porter narrates the following incident which occurred on 2 May, the day prior to the Confederate evacuation of Yorktown:

> On another day late in the afternoon I had reason to suspect the enemy was making arrangements to abandon the works. He pretended to convey the impression of intention to attack us. I ascended in the balloon and was rapidly fired upon causing many of the men holding the ropes to run away and thus impress me that the ropes would break free again. My impressions were confirmed. A battalion or brigade was moving out of Yorktown toward Richmond, and was some distance away, when the sight of the balloon caused them to be faced about and marched towards Yorktown evidently to create the impression that they were strengthening the garrison instead of deserting it.[9]

Lowe's noon observation on 3 May from Warwick Court-House revealed no indications of an impending Confederate

withdrawal, in fact, he reported construction on earth works in the vicinity. Later that afternoon, Lowe ascended with Porter in front of Yorktown only to have heavy artillery fire directed at them. Porter ordered the balloon lowered immediately and directed the aeronaut to cease operating from this spot since the area was full of Federal camps.[10]

Colonel Cabell, General Magruder's Chief of Artillery during the siege, made no mention in his report of the firing on the Union balloon.[11]

That night the Confederates fired upon the Federal positions until 2 a.m. on the 4th. Heintzelman, fearful of a Confederate withdrawal, had his staff officer, Captain Moses, awake Professor Lowe with an order for the aeronaut to ascend and have a look. Lowe initially reported an isolated fire near the waterfront, but changed his mind on his next ascent as light from the rising sun revealed empty trenches. This information he reported to Heintzelman, who had just been telegraphed the same information by Porter. Heintzelman went aloft with the aeronaut for confirmation, and telegraphed the news of the withdrawal from the balloon car to headquarters. At 6 a.m. enemy troops were sighted by Lowe about two miles out of Yorktown on the road to Williamsburg. An hour later Porter's balloon was moved into Yorktown for an observation of the York River. Lowe reported several Confederate boats in view, which navy gunboats quickly captured.[12]

Second Lieutenant George Armstrong Custer, ordered by General "Baldy" Smith to make daily ascensions in the balloon attached to the 4th Corps, also claimed to have been the first to report the Yorktown evacuation by balloon. Custer's report bears a striking resemblance to Lowe's, and lacks supporting evidence other than Captain Glassford's article which fails to mention a source. While Smith wrote of his encounter with two contrabands shortly after sunrise who reported deserted works across the river, he made no mention of Custer's information, only that Custer crossed the Warwick via the dam at about 5:30 a.m. on the 4th to seize the empty Confederate positions. Heintzelman wrote of troops "advancing on the right" which, from the location of the balloons, could only have been Porter's troops who had ordered his men forward at about 3:30 a.m., and not Baldy Smith's.[13]

The Confederate balloonist, Captain Bryan, conducted his third and final ascent on the night of 3 May from behind Wynn's Mill. He reported to General Johnston the disposition of Union troops as the Confederates evacuated Yorktown.[14]

Colonel H.C. Cabell, Chief of Artillery in the First Virginia Artillery, reported that lead elements of the Confederate evacuation were in Williamsburg by 2 a.m. when the artillery fire ceased. General Stuart, commanding the Confederate rear guard, wrote that the last troops passed

his position at Blow's Mill after sunrise.[15] From the available evidence, it appears that Lowe in fact saw the tail end of the Confederate evacuation, though it proved of little value to the Union commanders.

Up to this point in the campaign, the balloons proved useful in terms of observation platforms in support of the siege operations. General Barnard was able to assess the Confederate fortifications from the vantage point provided by them. Balloons enabled draftsmen to sketch accurate maps of the area. Both sides suffered from a lack of maps in this campaign, though the Confederates enjoyed the support of the natives. The balloon provided the only bird's-eye view of this otherwise flat and unknown terrain.

One criticism of their efforts, at this stage of the war, was their inability to generate useful estimates of the enemy. Despite some open terrain on the peninsula, particularly along the roads, the vast majority of the land was covered by trees. Lowe did report wagon movement to and from Yorktown, though it was difficult to ascertain the direction the supplies were flowing. Of the enemy troops already in contact, Magruder's forces were north of the Warwick River and entrenched in forested positions, thus they were effectively screened from view. Their camp fires attracted artillery fire; consequently Lowe was denied this means of estimating Confederate strengths as well.

## On to Richmond

General Joseph E. Johnston, commanding Department of Northern Virginia, elected to withdraw from the peninsula once the Union artillery was postured to shoot upon the Yorktown fortifications. The loss of Yorktown, and consequently the York River, placed any Confederates remaining on the peninsula in jeopardy of encirclement through the Union's command of the waterways. The morning of 7 May found the retreating army centered at Barhamsville, three miles southwest of West Point, the landing site of Franklin's Division that morning. General Whiting was ordered to dislodge the enemy, a task he reportedly accomplished.

The departure of the Confederates from the peninsula led them to abandoning Norfolk on 9 May as well. The next day General Wool, Commanding Officer of Fortress Monroe, took a force and occupied the only naval facility then available to dock the Merrimac. The subsequent scuttling of the ironclad by the Confederates opened the James River to the Union Navy.[16]

Johnston's final selection of a defensive line around Richmond was shaped on 15 May by the Union gunboats shelling Confederate batteries seven miles south of the capital on Drewry's Bluff overlooking the James River. Johnston's defensive position was centrally located three miles east of Richmond, anchored by the defenses at Drewry's

Bluff, and enabled a quick response to Union maneuvers from either West Point, the James River, or along the Chickahominy River.[17]

McClellan elected to split his army in order to follow the retreating Confederates after the battle of Williamsburg on 5 May. Exercising Union control of the waterways, McClellan transported the four divisions belonging to Franklin, Sedgwick, Porter, and Richardson up the York River to West Point. Franklin arrived at West Point on the 7th. The remainder of McClellan's army and wagon trains plodded up the peninsula through the oozing mud. General Stoneman reestablished communications between the two wings of McClellan's divided army within two days of the 8th, when he first received the order.

McClellan reorganized the Army of the Potomac in the middle of May with the approval of President Lincoln. Porter and Franklin were each given command of a two division corps consisting of their old commands and one other. Franklin was given Smith's division, while Porter received Sykes'.[18]

On 21 May, McClellan's army was postured with Stoneman's advanced guard within a mile of New Bridge on the Chickahominy River, Franklin's Corps was two miles behind Stoneman, while Porter's Corps was in supporting distance of Franklin. Sumner's Corps connected the two wings in its location three miles from the Chickahominy. Keyes' Corps

was near Bottom's Bridge, while Heintzelman was supporting to the rear of Keyes.[19]

On 4 May, Lowe received orders to load his gear on the balloon barge and sail with General Franklin's Division to West Point at the head of the York River on the north side of the peninsula, thus missing the battle of Williamsburg. Lowe inflated one balloon and operated from the stern of the barge while at West Point, though neither Franklin nor his subordinates make mention of them during the engagement on 7 May.[20]

From the head of the York River, Lowe moved the balloons via the Pamunkey River to White House Landing. On 18 May, Lowe was tasked to provide coverage for General Stoneman as part of the advanced guard for McClellan's march on Richmond. This innovative tasking proved to be quite effective, though this was the only time it was used in the Civil War. Stoneman's force consisted of cavalry, horse artillery, and two infantry regiments.[21] This force and Lowe's balloon reached the Chickahominy River on the 20th, and New Bridge on the 21st. Lowe's first view of Richmond from the balloon occurred the morning of the 21st with General Stoneman alongside. Stoneman used the ascent to spot the enemy and then moved his force and Lowe's balloon to Gaines' Hill.[22]

With his advanced guard seven miles away, McClellan was now postured to advance on Richmond. He possessed a

base of supply at White House Landing and the rail line running the 23 miles due west from it to the capital. His troops were rebuilding the rail bridge, in addition to others, across the Chickahominy to ease the burden of advancing men and supplies. His estimates of enemy strength provided by Pinkerton were exceedingly high, about double their actual strength of 75,000. Lacking adequate manpower, in his mind, McClellan elected to maximize his technological advantage in guns, and lay siege. Try as he may, McClellan was unable to get McDowell's Corps of 30,000 men united under his command.[23]

McClellan's advance on Richmond initially placed four of five corps north of the Chickahominy. Baldy Smith's division became the right flank of the Army of the Potomac having battled their way into Mechanicsville in support of General Stoneman on 24 May. Keyes' corps was the only force south of the river on the 24th, having pushed five miles west from Bottom's Bridge on the 20th to Seven Pines. Keyes' men became the left flank of the Union army just to the south of the York River Railroad.[24]

24 May 1862, witnessed the first combined use of balloon, artillery, and troops effectively orchestrated by the commander aloft. Stoneman, using Lowe's balloon as an observation platform, directed his battery commanders' fire against the Confederate force spotted on the river bank near New Bridge, eight miles upriver from Bottom's Bridge.

Captain Tidball, Second U.S. Artillery battery commander, reported expending 93 rounds in the affair in which he never saw the enemy, but balloon observers reported the Confederates to have fled.[25] According to Lowe, the enemy was driven back over a mile by this indirect artillery fire. At the completion of this fight, Lowe remained with the balloon while Stoneman sallied forth to capture Mechanicsville.[26] A Richmond paper of 26 May described the day's events:

> The enemy are fast making their appearance on the banks of the Chickahominy. Yesterday they had a balloon in the air the whole day, it being witnessed by many of our citizens from the streets and house tops. They evidently discovered something of importance to them, for at 4 p.m. a brisk cannonading was heard at Mechanicsville and the Yankees now occupy that place.[27]

On 26 May, Lowe was informed by General A. A. Humphreys, Chief of Topographical Engineers, that by McClellan's Special Order Number 157, dated 25 May, the balloon department and Professor Lowe were now in his charge. Additionally, Lowe was tasked to provide balloons to Generals McClellan, Stoneman, and Keyes located near New Bridge, Mechanicsville, and Seven Pines respectively. The chief aeronaut was only able to supply balloons to the former two locations in time for the first battle. On the 26th, Lowe was further directed to limit ascensions to the general commanding the sector, his designated representatives, and "that newspaper correspondents and reporters be in no case permitted to ascend."[28]

One indicator of the Confederate concern for the Union aeronauts lies in the vast quantities of artillery and rifle ordnance expended attempting to shoot them down. Lowe learned to take precautions against the Confederate advances by moving the ground mooring wires of the balloon, thus changing the enemy's aim point. On 27 May, Lowe made the following afternoon report:

> At 5 o'clock three batteries opened upon me, firing many shots, some falling short and some passing beyond the balloon and one over it, while it was still at an elevation of 300 to 400 feet. A battle is going on about four miles distant; heavy cannonading and musketry. I will go up again and report.[29]

The sounds of battle Lowe reported came from the successful Union engagement near Hanover Court-House involving General Porter's division with a Confederate brigade belonging to General Branch. Porter's troops were out cutting the rail lines to the Confederate screening force between McClellan's army and McDowell's corps which was then moving south from Fredericksburg. However, Stonewall Jackson's advance up the Shenandoah Valley induced a cautious President Lincoln to, once again, redi[illegible] McDowell away from Richmond, as General Robert E. Lee had hoped when he suggested the maneuver.[30]

## Seven Pines

Lowe reported to General Humphreys following his 5:30 p.m. ascent near New Bridge, on 27 May, in which he reported the general disposition of Confederate positions

around Richmond. The enemy main camps were located near the eastern bank of the James River just south of Richmond. The next heaviest concentration of camps were found to the north of the capital along the road to Mechanicsville. The aeronaut located Porter's successful engagement ten miles to the north near the Pamunkey River, but was unable to describe any of the movements due to the distance and heavy trees which obstructed his vision.[31] Figure 5 illustrates the area of operations east of Richmond.

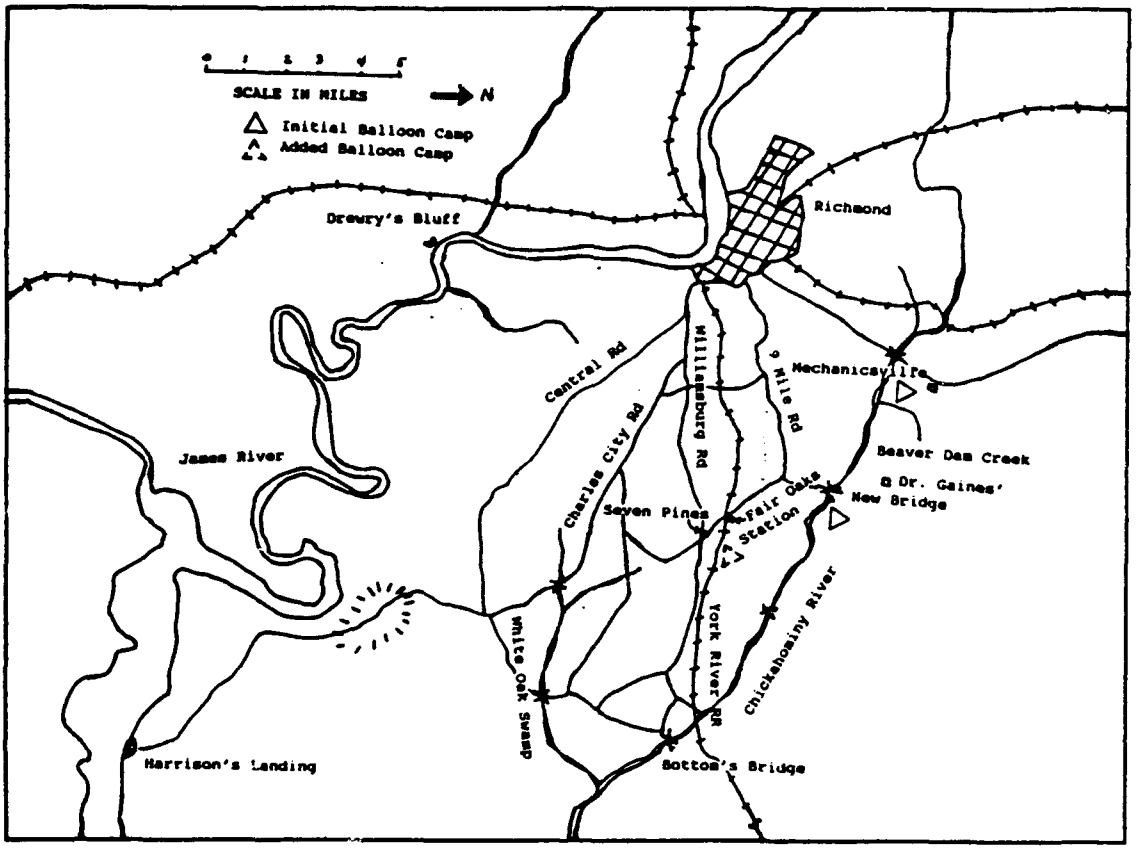


**Figure 5.** Balloons along the Chickahominy

While I am unable to find exact troop locations, Lowe's observation of Confederate troop dispositions makes sense in light of Johnston's earlier description of his Richmond defenders.

McClellan recalled Porter's troops to their original camps near Mechanicsville on 28 May when it became clear that McDowell's Corps would not join him at Richmond. The next day he moved Heintzelman's Corps south of the Chickahominy guarding Bottom's Bridge and his left flank along White Oak Swamp in support of Keyes' leaving the corps of Porter, Franklin, and Sumner north of the river. McClellan's plan was to advance the two corps south of the river along the rail line which connected his army to its depot. The advance would uncover bridges as well, which at that time were under construction, and thereby shorten the 12 mile ride via Bottom's Bridge currently required to connect the two wings of McClellan's army.[32]

While McClellan advanced ever so slowly on Richmond, Johnston bided his time in defensive positions waiting for an opportunity to seize the initiative from his counterpart. He began shifting his troops into positions to attack McClellan's isolated forces south of the river on the 29th once he determined that McDowell's forces were heading away. On 30 May, Johnston's scouts reported, in error, that General Keyes' corps was the sole Union force encamped on the south side of the Chickahominy. His intention was to

attack and destroy the enemy at dawn on the 31st, and return to his initial defensive positions.[33] As luck would have it, the rain began that afternoon and continued until well into the evening causing the Chickahominy River to rise and the gap between McClellan's wings to widen.

Lowe sighted the concentration fr[illegible] balloon located at Dr. Gaines' house near New Bridge, and began reporting this information to General Humphreys at headquarters starting 11 a.m. on the 29th. Lowe's extensive field of view from this location included the following roads: New Bridge, Williamsburg, Charles City, and Central. His twilight ascent closed with the following summary for the day, "They seem to be strengthening on our left, opposite this place."[34]

The Official Records contained no reports from Lowe on the 30th, although weather appears to have been the culprit. Heavy thunderstorms began that afternoon, continued on into the night, and threatened to sweep away the bridges linking the Union army together across the Chickahominy River.[35]

Lowe's claim for credit that McClellan responded mainly to his warnings of Confederate troop concentrations, cannot be substantiated by the available reports in the Official Records. In addition to Lowe's observations, much of the general's information was available through captured soldiers as well, even though troop estimates provided from

this source were often erroneous. McClellan reported large numbers of Confederates around Casey's division on the 30th, the same day no balloon reports were available, and the Confederates were probing Union positions. That same day Heintzelman received permission to reposture his forces as he saw fit.[36] I could find no references to reflect changing bridge completion schedules which would therefore speed the arrival of General Sumner's corps on the 31st. While unable to validate Lowe's claim to full credit for the discovery, his reports certainly supported McClellan's requirement for information that enabled him to safeguard his army.

The following initial Confederate positions were taken from Johnston's and Smith's after-action reports of Fair Oaks. Johnston massed his forces due east of Richmond opposite his intended point of attack. Hill's division, the easternmost, blocked the Williamsburg and Charles City Roads. Both Huger's and Longstreet's divisions camped to the west of Hill's division. General Smith's division was located to the north of Longstreet's, while Magruder's, the furthest north, guarded the river crossings opposite Mechanicsville.[37]

As the lead wing in Johnston's attack, General Longstreet sounded the advance on McClellan's troops at 2 p.m. on the 31st, six hours later than originally intended due to unit delays in reaching their assigned departure

positions. Hill's men advanced east along the Williamsburg Road and York River Railroad to Seven Pines with Longstreet's division in support. Hill's division became fully engaged by 3 p.m. General Huger's division, while expected to attack from the Charles City Road into the southern flank of the enemy units at Seven Pines, missed much of the battle waiting for orders. Poor coordination with Longstreet resulted in General Gustavus W. Smith directing his left wing into action two to three hours later than the right. His division, then led by General Whiting, advanced along New Bridge Road into the north flank of the enemy at Seven Pines about 5 p.m. Initially, two Union divisions defended against three Confederate.[38]

One major flaw surfaced from the accounts found in the Official Records provided by Lowe in which the aeronaut claimed credit for McClellan's decision to move Sumner's Corps. The Prince de Joinville, a foreign observer in McClellan's camp, gave credit to the aeronauts as well.[39] In contrast, Stephen W. Sears in his book, To the Gates of Richmond, noted that the original balloon report found in McClellan's Papers recorded Lowe's ascent at 2 p.m. High winds, as recorded in the Comte de Paris' journal for 31 May, precluded morning ascents by the aeronauts before that time, despite Lowe's assertion to the contrary. The Comte de Paris was the nephew of the Prince de Joinville and in

this case the journals and recollection contradict. Lowe's statement from the Official Records follows:

> On the 31st of May, at noon, I ascended at Mechanicsville, and discovered the bodies of the enemy and trains of wagons moving from Richmond toward Fair Oaks. I remained in the air watching their movements until nearly 2 o'clock, when I saw the enemy form a line of battle, and cannonading immediately commenced. Not having any telegraphic communication here, I dispatched one of my assistants with a verbal message....[40]

It appears, by comparing the Official Records to the account provided by Sears, that Lowe claimed credit for warning McClellan to action, which the full record does not, in fact, support.[41]

Lowe's 4:30 p.m. report to General Marcy, McClellan's Chief of Staff, observed from the balloon near Doctor Gaines House, follows:

> There are large bodies of troops in the open field beyond the opposite heights on the New Bridge Road. White-covered wagons are rapidly moving toward the point of the engagement with artillery in the advance. The firing on our left has ceased.[42]

This report accurately reflected the advance of General Whiting's division into battle, although the battle was out of McClellan's hands at this stage since he had already committed Sumner's corps to the engagement two hours earlier in response to the sounds of battle and initial reports from Heintzelman.[43]

After the campaign, Major Albert J. Myer, McClellan's Chief Signal Officer, reported that thick forests and poor visibility hindered his officers in the performance of their primary duties of signalling

battlefield observation, and as a result many performed staff services.[44] Unlike the service of the signal officers in the battle, Lowe's reports on the 31st confirmed a major action was unfolding for headquarters. However, the information came too late as McClellan apparently ordered Sumner's corps across the Chickahominy at 3 p.m., before the balloon reports were available. Heintzelman, commanding the left wing, was separated even further from the balloon information since he was away from the telegraph, located in his camp, directing troops into battle. Although Lowe apparently revised history in order to claim credit for his balloon service, he supported General McClellan with information from an alternative source to the couriers provided by the general's subordinates.

General Casey's division of inexperienced troops bore the brunt of the Confederate assault and in some cases scattered. General Couch's division supported Casey on the right. The Union reinforced their retreating line throughout the afternoon with the two divisions from Sumner's corps and Hooker's division which Heintzelman had pushed forward. The line stiffened and held as the replacements poured in and darkness began to fall. The Union troops reorganized their line that night in preparation for the fight the next morning.[45]

General G.W. Smith succeeded General Johnston in command when the latter was wounded about sunset of the

31st. Smith, sensing Johnston's plan was unfinished, advanced Longstreet's men the next morning along the rail line. Smith would commit Whiting's troops, located on the New Bridge road, once the battle was developed. Longstreet's fresh and inexperienced troops faced increasingly stiff resistance. Union counterattacks caused many units to flee. Smith failed to act with Whiting's men at the sound of muskets, and by 11:30 a.m. the battle faded to an end. Following the battle that afternoon, Jefferson Davis replaced General Smith with his aide, General Robert E. Lee, as commander of the Confederate army.[46]

The Confederates attacked Kearny's and Richardson's troops shortly after dawn the next morning. In response to the Confederate move, Heintzelman ordered General Hooker's division forward to counterattack. The move was a success as the Federal troops won back much of the terrain lost during the previous day's fighting.[47]

Professor Lowe ascended at 4 a.m., but fog denied him a meaningful observation for two hours. At 7 a.m., following an hour long observation, he sent the following report from Dr. Gaines' House to General Marcy:

> I have just obtained a splendid observation from the balloon. I find the enemy in large force on the New Bridge road, about three miles this side of Richmond. In fact, all of the roads that are visible are filled with infantry and cavalry moving toward Fair Oaks Station. There is also a large force opposite here, and in the same position that they were in yesterday, but not in motion. I can see smoke in the woods where the firing ceased last night, I hear no firing at the

present. In the immediate vicinity of the heights opposite here there are nothing but pickets visible."[48]

Lowe's observation spotted Whiting's troops located on the New Bridge road and those directly opposite him on the south side of the Chickahominy. While this description was accurate, there is no evidence that the Union generals ever used it. McClellan was suffering from malaria, and the troops north of the river were ill positioned with respect to the available bridges to reinforce any action to the south. Heintzelman, commanding the left wing, was out directing Hooker into action as Lowe transmitted his report. There were no follow up attacks on the 1st.

Fifteen minutes prior to Lowe's first report, General Humphreys telegraphed to the chief aeronaut his anxious desires to be kept informed of Confederate movements. He wished the balloons to report every fifteen minutes. Lowe's assistant, James Allen, accompanied by Porter's aide, Major Webb, made ascensions from Mechanicsville that morning and reported on brigade movements in their view. The remainder of the day, Lowe was actively reporting and responding to inquiries from Generals Humphreys, Marcy, Porter's assistant, Martindale, and Porter.[49] Though the Union generals all tried to use the balloon to build a picture of the enemy situation, all failed to capitalize on the information provided with offensive action.

The combination of limited bridging across the swollen river, sick commander, mud, and poor communications above the division level all contributed to the failure of the Union army to exploit the momentum gained on the second day of the battle. Hooker performed a reconnaissance in force on the 2nd, but stopped once he had regained the original line held by Casey.

## Seven-Days' Battles

Over the course of the next three weeks, McClellan focused the energy of his army upon building bridges across the Chickahominy. As the engineers constructed crossings, the general sent out armed reconnaissance south of the Chickahominy to locate Lee's positions. The front stabilized along the previous line held by Casey's division before the battle of Seven Pines. With the bridges repaired, McClellan shifted all but Porter's Corps south of the river.[50]

While McClellan built bridges, Lee built fortifications in front of Richmond. On 13 June, he launched J.E.B. Stuart's raid to probe McClellan's right flank located north of the Chickahominy. Stuart took the opportunity to ride full circle around McClellan. Lee probed the front of the Union positions as well, looking for weaknesses.[51]

The static lines confronting Lowe's balloon operations on the 2nd continued for the next three and a

half weeks. During the afternoon of the 3rd, Marcy asked Lowe to confirm enemy troop movements in front of Heintzelman and Sumner to which Lowe responded that he could "...discover no new movements of the enemy today."[52] General Bernard ascended repeatedly with Lowe, observing this time the Richmond defenses. On the 7th, a map-maker, Mr. Babcock, went aloft to help draw the surrounding country. On the 13th, Lowe again responded to tasking and performed his familiar security role for the army by dispelling rumors of Confederate movements. From 14 to 17 June, Lowe watched, mapped, and reported Confederate earthwork construction all around Richmond.[53]

On the 19th Lowe put a third balloon in operation near McClellan's new headquarters, Camp Lincoln, located south of the Chickahominy River. From the initiation of balloon operations there on the 19th until the 27th, Lowe conducted his ascensions and made only verbal reports. He kept no copies of these reports.[54]

Having fortified the defenses in front of Richmond, Lee reduced the manpower requirement for effective defense of the capital. Lee elected to attack the right flank of McClellan's army using Jackson's corps from the Shenandoah valley in conjunction with units now freed from the trenches. The exposed right flank was the only portion of the Federal line that was not heavily fortified, and once again, the Confederates were able to attack a corps isolated

from the remainder of McClellan's army by the Chickahominy River. Lee believed that by flanking the Union army here, he would threaten their rail line, draw them from their works, and annihilate them piece by piece. Jackson was to initiate the battle at Mechanicsville along Beaver Dam Creek at dawn on 26 June.[55]

McClellan's precaution to the news of Jackson's approach was his order to prepare to shift the depot at White House to Harrison's Landing on the James River. With this order in process he elected to wait for the coming storm.[56]

Lee's plan, though simple in explanation, proved difficult to execute for want of better coordination. Hill arrived several hours late and the dawn attack took place in the mid-afternoon. Jackson's corps was unable to engage until the morning of the 27th, when Porter's troops were already pulling back.[57]

Lowe made a verbal report to Humphreys concerning the Confederate troop concentration around Mechanicsville, but no written record was made. Stephen Sears, in his book, To the Gates of Richmond, points out that once again the Chief Aeronaut did not have a balloon in the air all that morning, though no explanation was given.[58]

McClellan elected to withdraw Porter's corps to Gaines' Mill once he confirmed that Jackson's forces had genuinely arrived. Porter's troops were in their new

defensive positions by noon and the battle began two hours later. Before the battle was joined, Porter had already asked for reinforcements from McClellan thereby precluding any warning role for the aeronaut. The general responded by sending Slocum's division that afternoon.[59]

Lowe was feeling ill from the strain of the campaign; however, he managed to ascend throughout the 27th at headquarters, reporting to Humphreys. At 9:20 a.m. Lowe sighted E.P. Alexander's balloon at 300 feet, and four miles west of Camp Lincoln. At the same time, Lowe heard rifle fire to his left which in conjunction with the sighted balloon was misinterpreted by the aeronaut to indicate that a Confederate attack was imminent on the Union left. Lowe stayed aloft for the remainder of the day providing McClellan with reports of the battle. However, with McClellan predisposed as to troop movements, the aeronaut merely provided security for the general of impending attack elsewhere along his line since McClellan believed his army to be outnumbered by Lee's. At 11 a.m., Lowe asked for Major Webb to go aloft with him, presumably to aid in the reporting of the upcoming tactical action.[60]

E.P. Alexander was aloft in his "silk dress" balloon as reported by Lowe on 27 June 1862. Alexander also claimed to have sighted Slocum's move to the north side of the river indicating he was aloft in the afternoon as well, but like Lowe's reporting, the information provided was old by the

time it reached the commander. There was no indication that Lee responded any differently to Alexander's news of Union reinforcements. In fact, the purpose of General Magruder's demonstration all along the Union left (which deceived Lowe) was to minimize Federal reinforcement of Porter north of the river.[61]

Lowe's reports on the 27th were the last recorded observations for the Peninsular Campaign. On the 28th he received orders to move with the retreating army, but for lack of wagons to transport his iron filings and acid, he was unable to inflate his balloons until he reached Harrison's Landing on the James River. During the retreat, Lowe was overcome with fever and his father took over the operation while he recovered. Lowe rejoined the balloon organization upon its recall to Washington from the Peninsula with the remainder of the Army of the Potomac in August 1862.[62]

## Summary

The Peninsular Campaign was the first opportunity for Lowe to demonstrate the utility of the balloon to the Army of the Potomac engaged in an offensive manner. Excepting the period of advance to Richmond, balloon employment supported the defensive nature of the commander who focused on siege warfare. The battles that occurred were in locations of the Confederates' choosing, thereby negating Union efforts to optimize their balloon locations.

Timeliness of reports throughout the campaign was poor when one focuses on the battles themselves, both of which were defensive and set-piece. High winds leading to the tardiness of balloon ascensions at the battle of Fair Oaks denied Lowe the opportunity to forcast the tactical action to the commander. McClellan responded to the growing sounds of battle when he sent Sumner's corps forward to reinforce, after which he was out of options. At Gaines' Mill, the stage was already set. McClellan knew the attack was coming, and he had Slocum's division prepared to respond. Had the balloons been postured to see the deception played by Magruder's troops, perhaps they may have affected McClellan's decision not to send more.

Aside from the battles, the advance of Stoneman's force under the protective eyes of Lowe's balloon proved to be the most effective offensive employment of balloons in the Civil War. Stoneman's ascents often preceded his movements for the day. He proved quite capable of directing an engagement from the balloon car via the telegraph, an event not to be repeated in the American army until the next century. Stoneman lost minimal time between discovering an opportunity and executing with his men.

In addition to the tactical applications of the balloons, they provided a significant advantage to an army operating in unfamiliar country enabling sketches of enemy positions and quality maps. Beyond map-making, Lowe's

primary mission throughout the campaign was to provide security to the army of a cautious general. The aeronauts provided some indicator of impending action before each of the tactical actions. At Fair Oaks, McClellan was aware of the gathering storm two days prior, while at Gaines' Mill, the general received balloon reports all that morning.

The aeronauts provided accurate information throughout the campaign, especially when army officers ascended with them. Lowe's reports of the Confederate withdrawal from Yorktown, and his reports of enemy troop concentrations on 29 May, two days prior to the Battle of Fair Oaks, proved to be on the mark. Additionally, he noted the movement of Whiting's division on 31 May, and the same body, now stationary, the next morning. Conversely, the sighting of Alexander's balloon by Lowe in conjunction with Magruder's demonstration led to his promoting the Confederate deception of an attack against the Union left prior to the battle of Gaines' Mill.

Operational considerations weighed heavily on balloon performance during the campaign. McClellan later wrote:

> In a clear atmosphere, and in a country not too much obstructed by woods, balloon reconnaissances made by intelligent officers are often of considerable value.[63]

Flat terrain covered by heavy forests limited the view of the aeronauts throughout much of the campaign. Fog, rain, and wind all played their part in denying the balloonist his

vantage point as well. Foul weather during the 30 hours leading up to the Battle of Fair Oaks certainly denied some useful observations as did early morning fog on the second day. Finally, the balloon barge enhanced the utility of the balloon while the army repositioned along the waterways.

Logistics adversely affected balloon operations only after McClellan ordered the army to retreat to the James. Lowe recorded that their supplies (iron filings) could not be transported to the rear when they were ordered back on 28 June. Consequently, Union balloons could not be inflated during the Seven-days Battles after Gaines' Mill until the army was established at Harrison's Landing.

The untiring efforts of the balloonists enhanced the army's capability with almost continuous service for the first 90 days of the campaign; however, their absence during a majority of the tactical action must be noted. Logistics did not impede operations until the campaign was decided before Richmond. Innovations in communication arrangements were tried including the telegraph in the balloon car reporting the battle, but timeliness of reporting was still an issue. All in all, the balloon corps exhibited normal growing pains to be expected during its first offensive campaign.

Following the Peninsular campaign in August 1862, McClellan's army was recalled to Washington by the President. The balloons were not transferred to Pope's army

in time for the battle of Second Manassas. A logistics conflict over wagon requirements precluded their uniting with the army prior to Antietam. The balloons rejoined the army three days after McClellan's victory in Maryland, but were again dispatched to Washington on 1 November when McClellan elected to follow Lee's army as it travelled south along the mountains.[64]

The balloons rejoined Burnside's command on 25 November in front of Fredericksburg. The General did not authorize ascensions until the morning of 13 December as he did not want the enemy to know his intentions. Since the balloon operated at Burnside's headquarters, all reports were made verbally and none were submitted into the Official Records. After this battle Lowe's aeronauts reverted to a familiar routine in which they again observed an enemy encamped for the winter. This activity would continue until General Hooker spurred the army onward to Chancellorsville the following April.[65]

## CHAPTER 5

## CHANCELLORSVILLE

Captain William A. Glassford, U.S. Signal Corps, in his article published thirty years after the war wrote:

> The last appearance of the war balloon of the old army was at the engagement of Chancellorsville; and no good seems to come of it there. General Butterfield [Hooker's chief of staff], who should know, writes: "I don't recall uses of any value at Chancellorsville. A study of the official reports might do so." A careful examination of all the official reports of that engagement fails to disclose that the aeronautical corps was of the slightest use over the field.[1]

While Series 1, Volume 25, Chancellorsville, of the Official Records contains no direct references to the balloon corps, Series 3, Volume 3, Correspondence, contains that portion of Thaddeus Lowe's dispatches and correspondence during the Civil War which were forwarded to the government for historical purposes. His dispatches included notes from Generals Hooker, Butterfield, and Sedgwick directing balloon operations during the Chancellorsville campaign, topics we will examine later.

April of 1863 found both North and South searching for a way to defeat the enemy army in detail and end the war on favorable terms. The armies, coming out of winter quarters, squared off across the Rappahannock River as they had the previous December after the Union defeat at the

Battle of Fredericksburg, Virginia. Major General "Fighting Joe" Hooker, Lincoln's fifth selection to lead the Army of the Potomac, assumed command in late January. General Lee had been in command of the Army of Northern Virginia since the Peninsular Campaign of the previous summer. Hooker's strength, as reported by Bigelow, totaled 138,000 men, while Lee's army amounted to 65,000.

Fredericksburg lay halfway between Washington D.C. and Richmond on the southwestern bank of the Rappahannock River. The town was situated on the interior bend in the river thus providing interior lines to the Confederates. The river originated forty miles to the northwest in the Bull Run Mountains and emptied eighty miles to the southeast into the Chesapeake Bay. Moving from south to north along the Rappahannock, between Port Royal and Fredericksburg, twelve miles distant, the Rappahannock was passable by pontoon bridge or boats (Beyond Port Royal the river widened considerably, eliminating pontoon bridges as options).[2] Continuing north, three crossings, significant to this campaign, existed in the nine miles between Fredericksburg and the fork where the Rapidan River joined the Rappahannock. The first two of these, Scott's and Banks' Ford, lay three and a half miles up river, but required a six mile march through forest on dirt roads for the Union forces. The third crossing, U.S. Ford, was a mile south of the fork, and yet required another seven mile march on roads

by Union troops. None of these crossings were fordable at the time of the campaign.[3] Twelve miles up the Rappahannock from the fork lay Kelly's Ford. Four miles up the Rapidan from the fork sat Ely's ford, while Germanna Ford was situated up stream another five from Ely's Ford. The rivers at these fords were still 200 to 300 feet wide. Except around Fredericksburg, the slopes from the water's edge rose quickly to 150 feet. Figure 6 depicts the region.

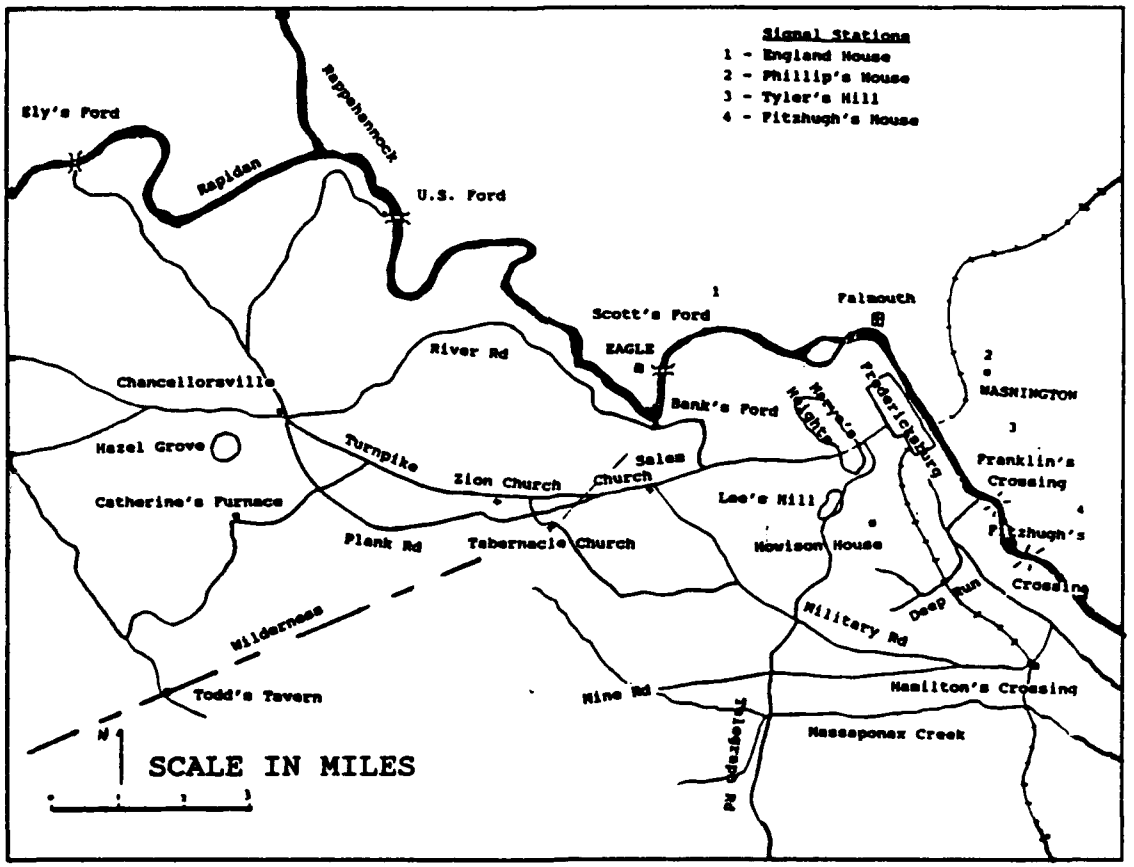


**Figure 6.** Chancellorsville Campaign

Like the river system, the road network in the area favored the Confederates in that the two paved roads were situated south of the Rappahannock, running from Fredericksburg to Chancellorsville. One was planked while the other layered with crushed rock. The remainder of the road network was built on clay soil with an occasional thin strata of gravel. These roads were impassable to heavy trains in wet weather unless paved with logs.[4]

Providing little help to the aeronaut, the rolling terrain surrounding Fredericksburg was abundantly covered with trees. The Terrain Map of Chancellorsville produced from the Official Records in 1936, by the Command and General Staff School, Fort Leavenworth, Kansas, revealed that over 75 percent of the terrain was covered with forest. The cleared areas predominantly followed the river system. South of the Rappahannock, the major portion of open terrain existed south of Fredericksburg extending some 5 miles down river and up to two miles inland. Brigadier General Gouverneur K. Warren, U.S. Army, Chief of Topographical Engineers, in his report to headquarters on 12 May 1863 described the Wilderness area:

> a region whose characteristic is a dense forest of oak or pine, with occasional clearings, rarely enough to prevent the riflemen concealed in one border from shooting across to the other side; a forest which, with but few exceptions, required the axmen to precede the artillery.[5]

Weather often denied direct observation by the aeronaut from the three balloon observation points used

during the campaign. These points were located at Banks' Ford, the Phillips' House near Falmouth Station, and White Oak Church.[6] Fog, which usually burned off by mid morning, restricted visibility. Wind, whether too gusty or strong, made it impossible to use field glasses with a steady hand or at times, to even get the balloon aloft.

An intersection one mile north of Banks' Ford, where the ground rose to 150 feet, was the most probable site for balloon *Eagle* under the charge of Mr. E.S. Allen. From this position, which was not established until three days into the campaign, the aeronaut could observe down the Confederate line along the heights behind Fredericksburg, as well as fill the gaps in coverage of the balloon located at Phillips' House.

The Phillips' House sat 5.1 miles due east of Banks' Ford, a mile back from the river on the high ground some 180 feet above the Rappahannock. In the balloon *Washington*, James Allen observed the Confederate lines and camps exposed on open ground south of the river as far as Bowling Green, twelve miles distant.

White Oak Church, three and a half miles further to the east-southeast of the Phillips' House, was the third balloon location used to observe the Confederate winter camps to the south. Mr. E.S. Allen and the balloon were relocated to Banks' Ford on the third day of the campaign.

Factoring in terrain and trees defines the road network and open terrain south of the Rappahannock that were visible to balloonists at Banks' Ford and the Phillips' House during the major activity of Hooker's campaign. The intersection of Military with Telegraph Roads was the primary source of Lowe's reports on 1 May, as can be seen in Figure 7.

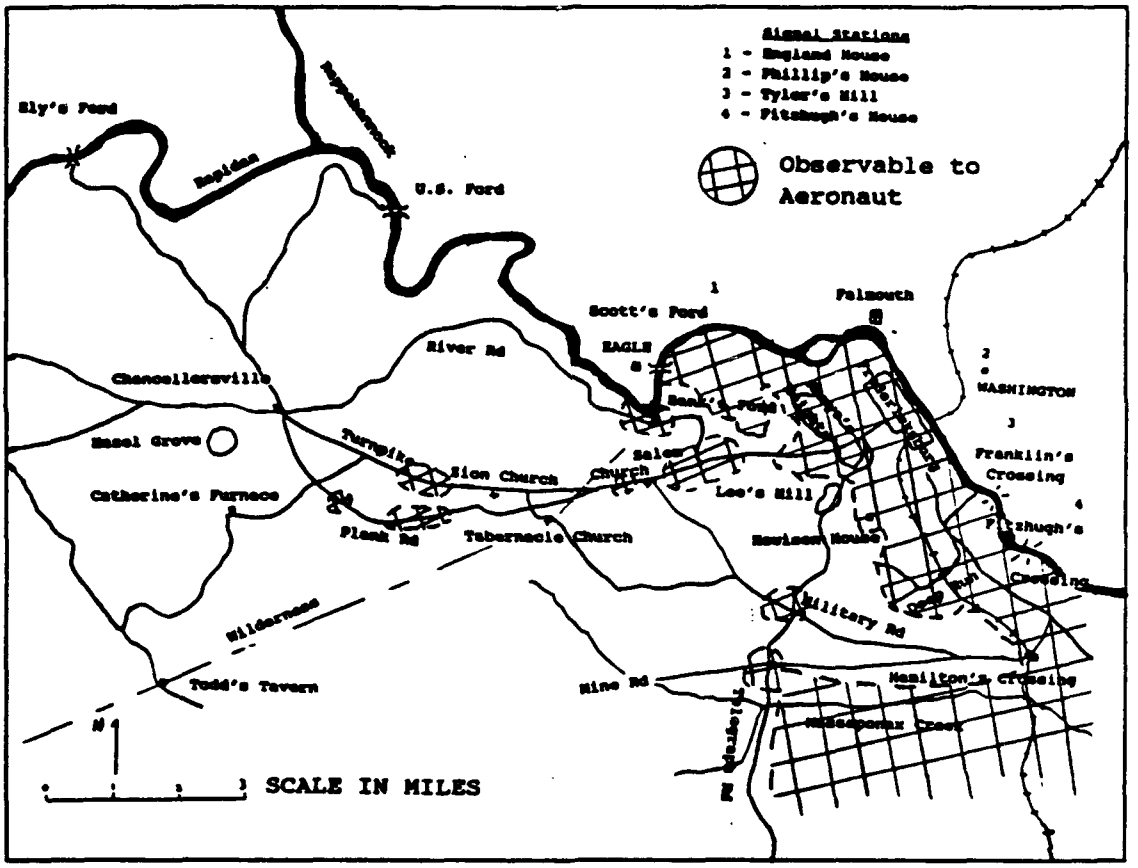


**Figure 7.** Field of view from Hooker's balloons

The balloon corps of the Army of the Potomac was reorganized by Major General Hooker on 7 April 1863 by his

Special Order Number 95.[7] Captain Cyrus B. Comstock, Chief Engineer of the Army of the Potomac, assumed command and administrative authority over the balloonists. Prior to this change, Lowe exercised control of the assigned personnel and communicated freely up the chain of command. This working relationship ended as Comstock took over, as external correspondence was now required to flow through the captain for approval. In his consolidation of power, Comstock freely countermanded Lowe's recommendations.[8] In a letter dated 12 April 1863, Comstock fired Lowe's father from his position as assistant while reducing Lowe's pay from 10 to 6 dollars per day.[9] Professor Lowe's response, also dated 12 April 1863, indicated he would resign if he were forced to serve under conditions to which he had not originally agreed.[10]

The operational organization of the balloon corps changed again prior to General Hooker unleashing his right wing on 27 April. Comstock was sent to Kelly's Ford to supervise the bridge building details and did not return until the conclusion of the campaign on 6 May. Thus, Professor Lowe found himself in charge again for the duration of the campaign despite his falling out with his military superior.

The balloons were positioned to observe the winter quarters of the Confederate army. The balloon *Washington* was located throughout the campaign at the Phillips' House,

while *Eagle* operated initially from White Oak Church and moved west to Banks' Ford on the 29th.

In February Longstreet and two of his divisions were detached from Lee's army for duty south of the James River. The initial disposition of Lee's remaining forces as they came out of winter quarters placed the two remaining divisions of Longstreet's Corps, Anderson's and McLaws', to the north in Fredericksburg, while Jackson's Corps protected the crossings to the south. The cavalry protected both flanks of Lee's army with Fitzhugh Lee's brigade picketing north of the fork (made with the Rapidan) along the Rappahannock and W.H.F. Lee's brigade south near Port Royal.

Of Longstreet's divisions, two brigades from Anderson's division led by Generals Mahone and Posey were positioned at U.S. Ford. Wilcox's brigade guarded Banks' Ford. Perry's brigade camped near the Old Mine Road three miles to the west of Fredericksburg. Finally, Wright's brigade lodged near Massaponax Church eight miles southwest on the Telegraph Road.[11] McLaws' division, excepting Kershaw's and half of Semmes' brigade, guarded the entrenchments behind Fredericksburg from opposite Falmouth in the north to two miles south of the town. Kershaw's brigade quartered west of Massaponax Church. Semmes' brigade was split, with half situated south of Salem Church in reserve while the other half performed picket duty along the Rappahannock opposite Falmouth.[12]

General Jackson's four divisions were located south of Fredericksburg along the river. Colston's division encamped nine miles southeast of Fredericksburg along the Rappahannock at Moss and Skinker's Neck. Early's division had recently moved into a wooded position west of Hamilton's Crossing three miles south of Fredericksburg. Rodes' division established camps at Grace Church, six miles south southeast of Fredericksburg and A.P. Hill's division was stationed two miles northeast of Rodes'.[13]

Union balloonists provided information on camp locations throughout the winter period via reports of direct observation, campfires and smoke. Lowe's aeronauts took observations regularly when the weather permitted, often moving the balloons while airborne several miles in the process. General Butterfield, Hooker's chief of staff, initiated a working relationship with Professor Lowe in early February 1863. Lowe's report, dated the 4th, described to General Butterfield following enemy disposition:

> From an observation taken this afternoon the enemy appear still in camp three miles west of Fredericksburg [Wilcox's brigade]; also a large camp south by west, about eight miles [Wright's and Kershaw's brigades]. The largest camp noticed appears to be south from the city about fifteen miles [Bowling Green winter quarters for the artillery]; also a smaller camp east by south.[14]

Lowe's report on the 7th described the hills opposite Fredericksburg as lined with small squad-sized units. On the 7th, General Butterfield directed the balloonists to

locate camps on maps provided by General Warren, the Chief of Topographical Engineers.

By 17 April, the number of observed camps had increased to 11. The following bearings were taken relative to the Phillips house by Mr. Allen: No. 1, west 5 miles (large camp) [Banks' Ford]; No. 2, west by south 3 miles [forested area behind Marye's Heights]; No. 3, west by south 6 to 8 miles [Tabernacle Church]; No. 4, southwest by west 2 miles (large camp) [Marye's Heights]; No. 5, southwest by west 12 to 15 miles (large camp) [Todd's Tavern vicinity]; No. 6, southwest 3 miles [Lee's Hill, forested]; No. 7, southwest by south 3 miles [woods east of Telegraph road, south of Lee's Hill]; No. 8, southwest by south 10 to 12 miles (large camp) [Massaponax Church]; No. 9, south 2 miles [mouth of Deep Run]; No. 10, south 3 to 4 miles [1 mile north of Hamilton's Crossing]; No. 11, south 8 to 10 miles (large camp) [Grace Church]; 3 or 4 small camps near the river bank, south by east [Moss Neck area].[15]

A comparison of Lowe's report with the initial Confederate positions stated earlier reveals two discrepancies. The first was the reported existence of a large camp near Todds' Tavern, when no troops were actually located there. This camp at Todd's Tavern could have been a ruse since it was far enough away to deny direct observation. The Confederates used deception the previous winter along the Potomac river by lighting extra or

eliminating camp fires as necessary to conceal their troop strengths and locations.[16] The second discrepancy was the lack of reports about fires in the vicinity of U.S. Ford despite the presence of two brigades from Anderson's division. Concealment of this position makes little sense since a major crossing site would most likely be guarded. I think Professor Lowe missed this camp, although no evidence can be found to prove the point either way. Thus, at the outset of the campaign the Union forces, through the use of balloon observation, had a fairly accurate picture of Confederate troop dispositions from which to gauge enemy reactions.

On the 21st, Lowe's sunset ascension was limited by haze which precluded a detailed examination of the enemy's position.[17] Lowe's double telescope field glasses permitted 80x magnification when otherwise unrestricted by visibility.[18] The next day, Lowe's observation, taken between 4 and 6 p.m., viewed "many regiments on parade" to the south (Grace Church). He estimated that the enemy force numbered "about three to our four." In addition, he estimated the troop strength immediately behind Fredericksburg at 10,000, while opposite Franklin's crossing and further to the south of it he guessed another 25,000. There were many more camps to the south and he believed that the Confederates were either strengthening their army or

moving troops forward from winter quarters at Bowling Green and Hanover Junction.[19]

Lowe's descriptions in these previous two reports leave much to be desired from the historian's perspective; my best guess as to what he wrote follows. Lowe's estimate of troops behind Fredericksburg seems high by about 3000 depending upon how far back the aeronaut meant by "immediately behind." If he meant the troops at Banks' Ford and Salem Church, he was fairly close. The 25,000 figure made for an even more difficult comparison. The aeronaut was vague in his description of the area. Verification was impossible unless one happened to share the balloon car with Lowe and guide with his finger, as he requested Captain Comstock to do the following morning. Excluding cavalry, the Confederates mustered 56,754 while the Army of the Potomac assembled 122,306 officers and men for duty or a 1 to 2 ratio in favor of the Union.[20]

On the morning of 27 April 1863, General Hooker launched his right wing, consisting of the V, XI, XII Corps, by way of Kelly's Ford, 27 miles to the northwest of Fredericksburg. Watching for the Confederate countermove, General Hooker, through his Chief of Staff, General Butterfield, had at his disposal one balloon located at White Oak Church, and a second at the Phillips' House, the remaining five were undergoing routine maintenance back in Washington. These vehicles offered the Union commander a

panoramic view of the battlefield. In addition, signal officers were stationed from southeast to northwest on the high ground at Buckner's Neck, Seddon's house, Phillips' House (armed with a telescope), and the England house. On the 29th, two additional stations were added between Phillips' and Seddon's house on Tyler's Hill and Fitzhugh's house. The latter station enabled direct observation of the rail line and depot at Hamilton's Crossing, four miles to the south of Fredericksburg.[21] Figure 8 depicts the signal officer's field of view on the 29th.

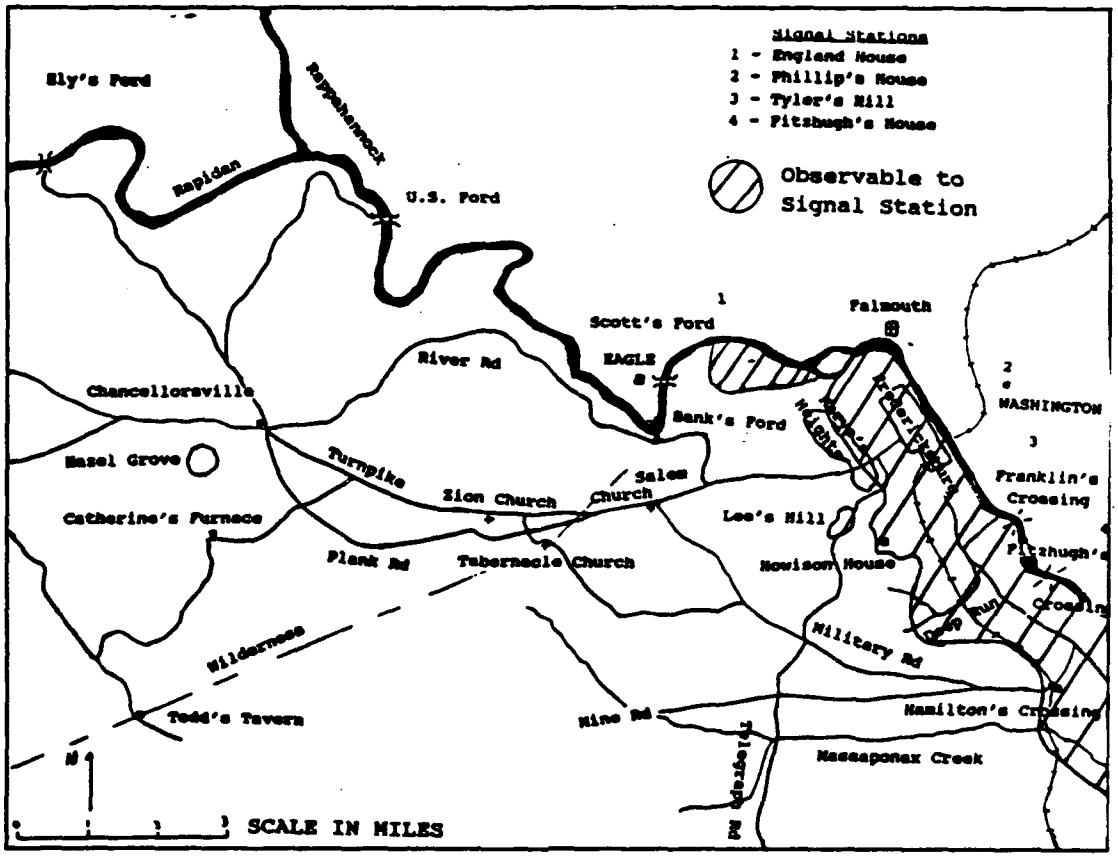


**Figure 8.** Field of view from signal stations

Unique to General Hooker's organization was his establishment of an intelligence collection point in his headquarters. He appointed Colonel George H. Sharpe, as Deputy Provost Marshal General, to run his intelligence center which fused information from scouts, spies, signal officers, and Lowe's balloonists.[22] The latter two of those sources listed were the ones with which he shared effective two-way communications.

Command and control was exercised using courier, signal flag, and telegraph. The Phillips' and England houses were connected to Franklin's Crossing by telegraph. The telegraph lines connecting the left and right wings at U.S. Ford were not in place until 9 p.m. on the 29th. Signal flags connecting the two wings were not established until the 29th either, due to the heavy rain from the previous day.[23]

On the 27th, General Butterfield put the balloons to use when he directed Professor Lowe to go aloft and make frequent reports to either himself or Sedgwick, in charge of the left wing. The next day, Hooker, through his aide-de camp, Lt. Oliver, directed Lowe to make an ascension with someone familiar with the terrain and enemy positions to observe the location of enemy camp fires.[24] While no balloon reports were available in the Official Records prior to the 29th, the lack of movement by the Confederates

coupled with the heavy rain storm reported on the 28th may have had an impact.

Using boats, Sedgwick launched his feint over Franklin's Crossing in a thick fog at 4:20 a.m. on Wednesday, 29 April. Five bridges were completed and the remainder of the two divisions in place across the Rappahannock by noon.[25] As the left wing commander, Sedgwick had the I, III, VI corps in position to cross should the enemy expose a weakness.

Lee awoke at dawn on the 29th to the news that the Federals were crossing the river south of Fredericksburg at the same location as the previous December. In addition, his telegraph to Richmond at 10 a.m. indicated that he knew General Howard's division with 14,000 enemy soldiers and some cavalry were across the Rappahannock south of Kelly's Ford. Lee reacted by relocating Jackson's corps to the northwest in between Deep Run and Massaponax Creek. He moved Wright's and Kershaw's brigades forward from Massaponax Church to support Early's left flank. Early reported his troops had moved into their positions on the rail line covering the front from Deep Creek in the north to Hamilton's Crossing in the south as soon as he was informed that the Federals had crossed to his front.[26] The Confederate supply trains all formed around Hamilton's Crossing. Lastly, Lee ordered the artillery forward from Bowling Green and Chesterfield. Not until 6:30 p.m., 19

minutes before sunset, did Lee receive reports from Stuart's cavalry indicating that at 1:30 p.m. the presence of two Union forces had been detected south of the Rapidan. The first was a large force of infantry screened by cavalry which had crossed at Germanna Ford, while at Ely's Ford only a cavalry force was reported.[27]

As Lee processed reports and directed his army into position through the fog on the morning of the 29th, Professor Lowe and his balloons were waiting for the weather to improve. Lowe's first recorded report was directed to Major General Sedgwick, Commanding Left Wing, Army of the Potomac, and dated at 10 a.m. on the 29th, with the balloon aloft, in which he passed three bits of information. First, the enemy line was formed at the edge of the woods along the base of the heights behind Fredericksburg. It stretched to well south of Fitzhugh's crossing and 4 miles south of Falmouth. Second, the Confederate line was thin compared to the Union's. Finally, the Confederate camps had not moved for as far as he could see.[28]

First, the report makes sense based on what was taking place in the Confederate camp. Second, Bigelow wrote that the fog lifted around 10 a.m., as Lee went forward to observe the Federal positions.[29] Lowe was making reports from the western most balloon located at Phillips' House in which he commanded a better view of Fredericksburg and the heights beyond. His visibility had to be at least 3.5 miles

or the distance to the southern crossing from his balloon location.

At 12 noon Lowe made the following report: "The enemy infantry are moving to our right about four miles below our crossing on a road just beyond the heights. The enemy do not appear to advance."[30] This report more probably matched the relocation of A.P. Hill's division behind Early's as Lee condensed his line towards Fredericksburg rather than Wright's brigade moving forward from Massaponax Church via Hamilton's Crossing. Wright's move probably followed the Telegraph road or western route to the area. Colston's division departed from Moss Neck and arrived at Hamilton Crossing in the evening, while General Ramseur of Rodes' division was placed south of Massaponax Creek the morning of the 29th.[31] Lowe was referring to the Mine road as it stretched west from Hamilton's Crossing, indicating that the visibility was at least five miles.

Lowe's next report, at 1:30 p.m., passed on two additional bits of information, first that the Confederate wagon trains were moving to their rear, and second, that their force in position opposite the Federal's was light, roughly the same number as the Union currently had across the river.[32]

The wagon movement indicated a major relocation of Confederate forces and further supported his noon report. The comparative strength was a different matter. Brooks'

division made up a quarter of Sedgwick's 22,500 man VI Corps, while Wadsworth made up a third of Reynold's 15,800 man I Corps.[33] Together they had roughly 11,000 men across the river. Directly opposing these Union forces was Early's division with Kershaw's, and Wofford's brigades on the line, while Wright's and half of Semmes' brigade were in reserve behind. This force totalled roughly 14,500 men, but only the forward positions were out of the woods and visible to Lowe.[34] The position of Semmes' brigade behind Lee's Hill was wooded as was the location of Wright's brigade on the Mine Road. Factoring out the reserve troops leaves some 12,000 men, not all of them in plain view. All told, Lowe's report was fairly accurate.

Lowe's last report of the afternoon at 2:45 p.m. indicated that two regiments had moved forward into the rifle-pits opposite the southern crossing and that smoke was visible six miles up river on the Confederate side in the woods.[35] I was unable to correlate the smoke for 2:45 p.m., since the nearest Confederate troops were those of Perry's brigade. Perry's troops were located between Salem and Tabernacle Church until that evening when they were ordered by the division to guard the crossings opposite Falmouth.[36]

Assuming unlimited visibility throughout balloon operations on the 29th, then the aeronauts should have seen Jackson's corps and trains relocating to the west, artillery moving forward from Bowling Green, and the reserve brigades

of Wright and Kershaw moving forward from Massaponax Church. Though the aeronauts reported on the movement of Jackson and his wagon trains, they did not provide the new enemy troop dispositions--no reports were made of the artillery moving forward (though these were small units). Kershaw moved forward at 8 a.m. while Wright moved upon receiving the order at 10:15 a.m. and was in position by noon.[37] Kershaw's move certainly occurred under cover of fog. For Wright's move to have been observed, assuming he went north on Telegraph road, Lowe would have required 6 miles of visibility by 11 a.m. to catch him in the open. As already stated, if Wright took the eastern path via Hamilton's Crossing Lowe may have in fact reported his unit as it headed west along the Mine road.

The other question that arose was why the last report occurred at 2:45 p.m. with sunset not until four hours later. The answer lay in the weather. General Warren wrote that at 5 p.m. on the 29th it began to rain and continued through the night.[38] General Wright categorized the rain as "drenching" during his brigade's midnight march west to Chancellorsville.[39]

Hooker, through his chief of staff, ordered a balloon repositioned on the 29th in order to, "know the comparative strength of the enemy's force at Franklin's Crossing, and in the vicinity of Banks' Ford, and above to the west of Fredericksburg."[40] Hooker, again through

Butterfield, commanded the balloon at Phillips' House to ascend before sunrise on the 30th in order to ascertain numbers, strength, and position of the enemy. These balloon observations were to be transmitted via the telegraph to headquarters. At 10 p.m. on the 29th, Professor Lowe directed Mr. E.S. Allen to relocate *Eagle* to Banks' Ford which, in fact, he accomplished by 3 a.m. on the 30th.[41]

Two significant points follow from Hooker's orders to Lowe. First, his specific request for comparative strengths and positions of the enemy indicated both he and Butterfield were aware of what information the balloons could provide. Lowe had certainly provided them in the past. Second, the positioning of the balloon at Banks' Ford in conjunction with the other at the Phillips' House enabled observation of all east-west troop movements on the roads between Fredericksburg and Chancellorsville. So Hooker and Butterfield were intimately involved with balloon operations and aware of the information that the aeronauts provided (contrary to the original quote of the chapter).

While Hooker relocated his assets, Lee did the same. At 9 p.m., Anderson was ordered to move Wright's brigade to Chancellorsville.[42] Wright moved out as previously noted in the rain at midnight, and, as it turned out, was concealed from enemy lookouts.

Though tasked to provide camp fire intelligence with nighttime ascents, Lowe provided no recorded information

prior to 10:45 a.m. on the 30th despite the balloon's arrival 9 hours earlier. Lowe hinted at the cause being weather when he wrote of his inability to get an observation until 10:45, and that low clouds had prevented him from seeing Bowling Green.[43] General Warren reported that at 8 a.m. the "mist of the morning"[44] so obscured his view that he could not see the enemy positions on the opposite side of U.S. Ford.

Figure 9 shows the Confederate troop dispositions at midnight of 29 April.

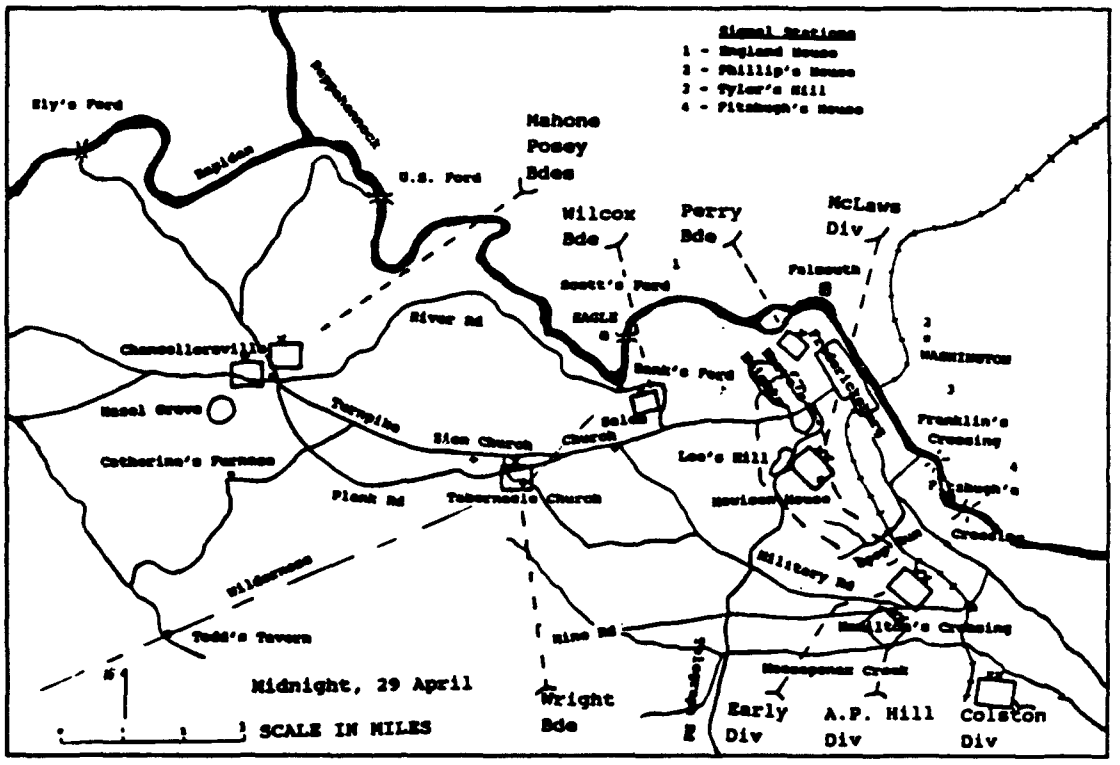


Figure 9. Confederate troop dispositions

Wright reported to Anderson in Chancellorsville at dawn. His brigade, together with Mahone's and Posey's, retired eastward and formed a defensive line at Zion Church by 10 a.m.[45] Stuart's cavalry discovered lead elements of Slocum's XII corps across the Rapidan at Germanna Ford by 8 a.m. Lee did not find this out until between 11 a.m. and 1 p.m.[46]

Hooker spent the remainder of the 30th concentrating his right wing corps under Couch, Meade, Slocum, and Howard at Chancellorsville.[47] His troops were in possession of U.S. Ford from which signal stations operated on both sides, the northern one connected by telegraph to Sedgwick's wing.

Hooker's headquarters received an observation from a signal station under Sedgwick's wing at 7 a.m. on the 30th. This note described the enemy defensive positions from Marye's Heights south to Hamilton's Crossing as relatively lightly defended with only two artillery batteries in view. Hooker attempted to make the most of this apparent weakness by ordering a demonstration in the direction of Hamilton's Crossing at 1 o'clock, unless Sedgwick believed the enemy to be there in full force. After an exchange of messages the demonstration idea was dropped with Sedgwick insisting that while no artillery was in view the Confederate infantry <u>was</u> there and in force.[48]

Lowe's first report of the day at 10:45 a.m. from Banks' Ford may have had an impact on Hooker's decision.

While he reported the detachments opposite Banks' and U.S. Fords as relatively small when compared to the Confederates across from Franklin's Crossing, he closed with, "The enemy's smokes are more numerous than usual in the rear of the heights opposite Franklin's Crossing below Fredericksburg."[49] This information reinforced the report by Sedgwick that the Confederate forces were still postured against the left wing.

Shortly after noon, Hooker ordered two of Sedgwick's bridges moved under cover of darkness to Banks' Ford and that Sickles' III Corps move, concealed from the enemy, to U.S. Ford in order to cross at 7 a.m. on the 1st. Sickles moved out at 1:30 p.m.[50]

Lowe's next report was transmitted at 1:30 p.m. to Butterfield from Banks' Ford in which he described the Confederate defenders at both his location and U.S. Ford as small in number when compared to the strength at the crossing south of Fredericksburg. He also reported the enemy had a battery in position guarding the road near him. Lowe was unable to provide accurate numbers due to the concealment provided by the pine woods.[51] The Official Records place Wilcox's brigade at Banks' Ford, while Bigelow placed him there with two batteries of artillery.[52]

In his final daylight report of 4:45 p.m., Lowe noted numerous camp fires about 10 miles southwest from his position, while there was no change to the enemy disposition

nearby at Banks' Ford.[53] The reported fires would have been in the vicinity of Todds' Tavern where the cavalry operations were in full force, but masked from the view of the aeronauts.

Lee waited much of the day patiently for an attack to come from Sedgwick's direction. By late in the day he began to shift his focus to the Union threat to the west in front of Chancellorsville. Lee would take the bulk of his forces west and leave behind the artillery reserve, Barksdale's brigade from McLaws' division covering Marye's Heights, and Early's division from Jackson's corps defending south of the heights. McLaws was to leave on the 30th at midnight, while Jackson would leave five hours later at sunrise.[54] Semmes' brigade moved out first at sunset on the 30th from his wooded position behind the Howison house.[55]

As it turned out, Lowe was aloft at the time Semmes' brigade started west, but the aeronaut was looking for camp-fires. After his 4:45 p.m. ascent, Lowe rode over to the Phillips' House and went up at 7 p.m. in the balloon *Washington*. He found the majority of the camp-fires in a ravine one mile behind the heights opposite the Union troops of the left wing extending from south of the lower crossing to north of the upper crossing. He also reported that there were many additional fires to the rear of Fredericksburg. Lowe concluded, "From all appearances I should judge that full three-fourths of the enemy's force is immediately back

and below Fredericksburg."[56] He forwarded this report to Butterfield at 8:30 p.m. on the 30th.

While little activity was reported this day by the balloons, Lowe in his 10:45 a.m. report reinforced the information provided to Hooker and Butterfield that the bulk of the Confederate forces were still postured against Sedgwick's forces south of Fredericksburg. As it turned out, this description was the correct disposition of Lee's forces. At the time of the night report, Anderson's division and Stuart's cavalry were screening Hooker's right wing while 5 of 6 divisions were south or west of Fredericksburg (roughly 80 percent of the Confederate forces).

Consolidation of command and control in Hooker's army continued. On the 30th at 3 p.m., the signal station at Buckner's Neck was disbanded, by direction. The telegraph line at U.S. Ford was extended across to a red brick house thereby shortening the distance for riders and speeding up communications between the two wings.[57]

Lee's forces began to reposition at midnight with McLaws' division leading the way. Early's division remained behind while the rest of Jackson's corps moved west with the sun at 5:04 a.m. on the 1st heading for Tabernacle Church. Jackson led his corps of roughly 26,000 men, organized by division, with Rodes forward followed by A.P. Hill and Colston. The divisions moved west in brigade-size columns

with supply trains in the rear. Jackson arrived at the church three hours later, sized up the situation, and decided to attack. The Confederates began their movement to contact about 11 a.m. on the 1st.[58]

Weather delayed the first ascent by aeronauts on the morning of the 1st. Both Reynolds and Butterfield, in their reports to superiors, referred to fog which later burned off.[59] At 9:15 a.m. while aloft at the Phillips' House, Lowe's initial report to Sedgwick stated:

> Heavy columns of the enemy's infantry and artillery are now moving up the river accompanied by many army wagons, the foremost column being about opposite Falmouth and three miles from the river. There is also a heavy reserve on the heights opposite the upper crossing, and all the rifle-pits are well filled.[60]

Rodes' division began their westward march at 3 a.m., while A.P. Hill and Colston postponed their departures until closer to sunrise at 5:04 a.m. that morning.[61] Since fog delayed the balloon activity until 9 a.m., Lowe's initial sighting was probably the tail of A.P. Hill's division as it crossed the Telegraph Road.

Again at 9:30 Lowe reported, "Still another column has just started from opposite the upper crossing, but not those mentioned as reserved in my last dispatch."[62]

Lowe's troop movement reports identified Confederate positions beyond the heights, thereby extending the battlefield for Hooker's army. The aeronauts alone could see them from their vantage point 1000 feet above the terrain. The 9:30 column Lowe sighted was again probably

crossing the Telegraph road about three miles southwest of Fredericksburg, it too belonged to Jackson's corps.

At 10 a.m. Lowe described yet another column crossing a creek that emptied into Banks' Ford. Additionally, he timed one of the previously sighted columns which took 30 minutes to pass a given point. Lowe closed the report with the sighting of long trains of wagons relocating westward.

The 10 a.m. report was the first that described a unit near Banks' Ford. This unit was probably Wilcox's brigade from Anderson's division which was ordered west from Banks' Ford on the 1st.[63] Perry reported his departure from opposite Falmouth as 11 a.m.[64] The inclusion of wagon trains signified to the commander that the units involved were making a permanent move.

The troop estimates provided by Lowe were being calculated by Butterfield who was diligently tracking Confederate movements for Hooker. E.P. Alexander described Jackson's trail of infantry (25,000 strong) on 2 May that stretched for 6 miles, the lead troops of which marched at 2.5 miles per hour, while the tail marched at 1.5.[65] An average of the two yielded 2 miles an hour speed of advance. The 30 minutes elapsed for a unit to pass a given point translated to a mile of troops, roughly two brigades, or 4000 men.

Lowe's 11 a.m. observation described the decay of the defenses facing Sedgwick. He could not see earth-works on the Bowling Green road, the guns appeared to have been removed from opposite Falmouth, and the defenders at Banks' Ford were gone. He described yet another wagon train heading west on the military road behind Early's division. In addition, he portrayed that while the enemy in the rifle-pits were unchanged in number, those behind on the heights were greatly reduced. His final comment of the report indicated the tents appeared as before.[66]

Unique to the vantage point of the aeronaut were the size of the wagon train beyond the heights, the estimate of troops in the heights, and the tent numbers. The remainder could be seen and reported by other sources. Perry's departure at 11 a.m. correlated to the removal of guns opposite Falmouth. The empty defenses at Banks' Ford strengthened the 10 a.m. observation of Wilcox's departure. As Lee ordered the majority of his army to move west leaving 10,000 behind, by 11 a.m. the holes should have been showing in the Confederate lines.

At 12:30 a.m. Lowe reported an engagement out to the west-northwest about twelve miles. In addition he spotted artillery at the intersection of Military and Telegraph road moving toward the battle. A large force between Deep Run and just south of the lower crossing was digging rifle-pits.

Finally, though the rifle-pits were strongly defended and the batteries were manned, few other troops were in sight.[67]

Lowe's mileage appeared to be off in his report of the engagement. From Phillips' House to the skirmish on the turnpike about 3 miles east of Chancellorsville measures closer to 9 miles. The remainder of the report supports earlier observations that the Confederates were improving their positions to enable the smaller force to defend.

At 2:15 p.m., Lowe reported no change immediately opposite the river, while further to the west the battle raged. Lowe closed his report with an invitation for a staff officer to ascend with him to observe and report on the battle.[68]

At 2:45 p.m., the Chief Aeronaut noted to Sedgwick that earth-works for artillery were being built near Deep Run. Again, an hour later, he reported no change immediately across the river, while the battle out west had started to die down.[69]

As Hooker gathered information on the enemy throughout the morning of the 1st, he elected to advance. The movement got underway by 11 a.m. with Meade's V Corps on the northern two roads, the River and Turnpike, while Howard's XII Corps moved east on the Plank road. Hooker ordered Sedgwick's wing to threaten an attack at 1 p.m.[70] Sedgwick received the order late in the day and executed a show of force closer to 6 p.m.

The two armies collided on the 1st of May along the Turnpike and Plank roads two miles east of Chancellorsville as the first shell exploded at 11:20 a.m. By 1 p.m. Sykes found himself practically cut off and informed Hooker of his dilemma.[71] At 12:30 Butterfield reported that all signal and balloon reports had been forwarded, and that in his view, no more than 10,000 to 15,000 Confederates could have been detached from Sedgwick's front since the fog had cleared.[72] Hooker ordered his army to return to the defensive positions around Chancellorsville at 2 in the afternoon. His telegraph to Butterfield of the same hour indicated his intentions for the left wing, "Tell Sedgwick to keep a sharp lookout, and attack if [he] can succeed."[73] Sedgwick used the telescope from the Phillips' House to conduct a reconnaissance of the Confederate positions opposite his headquarters at 4 p.m. that afternoon.[74]

There are two points to consider. First, the balloons were out of position to observe anything but the smoke of the battle this far to the west, as in fact they reported. The Wilderness was too dense except for isolated spots on the roads which lent themselves to reporting of troop formations. Once a formation dispersed from march column on the road in the Wilderness, the aeronaut could observe little. Second, while Butterfield's 12:30 report indicated the use of signal station and balloon reports to build the estimate of 10,000 to 15,000 troops moving west,

he probably had only one source, that being the aeronaut, sighting Jackson's columns in motion. Hill's division camped the previous night in the woods behind Early's troops and therefore was concealed from view. Colston's and A.P. Hill's divisions were marching west at dawn, while the fog did not burn off for another 3 to 4 hours, thus Colston's troops were probably concealed by trees before the signal officers had a chance to observe them. The easternmost division, Rodes', started marching at 3 a.m., and had only a 4 mile march until concealed west of Hamilton's Crossing. Unlike Jackson's units, Butterfield should have also had signal officer sightings of the 3,200 troops comprising Posey's and Wilcox's brigades which were withdrawn later in the morning from opposite Falmouth and Banks' Ford.

As Hooker fell back to his previous positions around Chancellorsville, Lee's army followed and spent the remainder of the day exploring for a weakness in the Union line. Fitzhugh Lee, on the extreme left of Stuart's cavalry, reported that the right flank was in the air. Howard's XII Corps held this Union flank which was strung out westward along the Turnpike unsupported by natural defenses. That evening Lee approved Jackson's plan to march his Corps of 25,000 men across the front of the Union army and attack the exposed flank. The corps would march at dawn, the 2nd of May. Lee would demonstrate with McLaws' and Anderson's divisions while the daring maneuver took

place.[75] At 2:30 a.m. on the 2nd, Wilcox was ordered to return to Banks' Ford, which he accomplished by dawn.[76]

With the retirement of Hooker's right wing to Chancellorsville, the balloons were unable to directly support the troops located there, but rather indirectly supported them by keeping a watchful eye on the Confederates defending against Sedgwick's forces. While the Official Records contain no reports from Lowe for the evening of the 1st, his initial report on the 2nd indicated that he had, in fact, been aloft.[77]

The morning of the 2nd was crystal clear, thanks to the high winds which inhibited the fog, and, unfortunately for Hooker, inhibited the balloonists as well. At 5:15 a.m. Butterfield requested that Lowe go aloft and locate the enemy troops. The general further petitioned the aeronaut to look for enemy movement toward Sedgwick.[78] One hour after the general's first request Lowe replied that the enemy had not moved from their last positions, and continued, "Owing to the high wind now prevailing I am unable to use a glass sufficiently to see whether there is movement on the roads."[79] At 7:30 a.m. Lowe related that the major roads to the west of Fredericksburg were clear, and that no reinforcements had been added to the enemy lines opposite his balloon. Fifteen minutes later Lowe reported heavy cannonading well to the west, while nearby the enemy were shelling Union troops.[80]

At 8:15 a.m. Butterfield queried Lowe if the enemy's strength had been decreased at all. Within 15 minutes the aeronaut responded, "I cannot say that the enemy have decreased, but they do not show themselves quite as much this morning, and I can see no reserves on the opposite heights."[81]

Lowe's reports revealed that little activity was taking place at the time, which was accurate. Sedgwick, as at sunset the day before, faced Early's division and Barksdale's brigade totalling roughly 10,000 men. While Lowe refused to commit to the reduction in overall numbers, their lack of both activity and reserves were a strong indicator the tactical situation had changed.

For the next three and a half hours Lowe was hampered by strong winds. At noon, Butterfield again asked Lowe why he was not aloft, to which Lowe replied that again the wind was too high to use his field glasses, but he reassured the general he would try again soon, as the wind was starting to calm down. At 1:05 p.m. Lowe reported that there was no change to the enemy's disposition opposite him, there were no enemy troop formations on the roads, and that his balloon had been blown from an altitude of 1000 feet down to nearly ground level.[82]

Captain Barton, a Confederate officer in Jackson's column during the flank march, wrote a letter to Bigelow after the war stating that he had seen a Federal balloon

while marching over the high ground near Catherine's Furnace.[83] As Lowe stated, his difficulty was a steady platform from which to hold binoculars. The fact that his balloon was blown to the ground indicates that wind gusts were in excess of 60 miles per hour. He reported enough trouble viewing the roads four miles from his location at the Phillips' House; there is little doubt that troops over 10 miles distant would have exceeded his capability given the wind.

Back at the Union headquarters, General Birney, commanding 1st Division in Sickles' III corps, from his position in Hazel Grove, informed Hooker of the enemy column crossing the army's front. Hooker weighed the possibility of a flank attack against Howard and directed the latter in a dispatch at 9:30 a.m. to take appropriate precautions.[84]

In regard to the left wing, Hooker decided to consolidate more of his forces at Chancellorsville. He sent Sedgwick an order at 1:55 a.m. to take up the bridges south of Fredericksburg and move them to U.S. Ford. Additionally, Reynolds' corps was to report to Hooker at Chancellorsville. Though the message was received too late to have the bridges up before dawn, Reynolds' corps reported to Hooker at 6 p.m. including Wadsworth's division which had to recross the river under fire.[85] Sedgwick's corps was left behind to fix the remaining Confederates at Fredericksburg.

By noon Lee was postured in defensive positions opposite the Union line about a mile to their east. Jackson's flank march was still six hours away from their attack positions. Late that morning, Early received instructions from Lee to leave a guard force behind at Fredericksburg and bring the rest of his troops to Chancellorsville. He began to execute this order, leaving 2500 men behind. Upon clarification from Lee that his previous order was not binding, Early returned to Fredericksburg and was in his original positions by 11 p.m.[66]

At 3:15 p.m. Lowe discovered enemy movement and forwarded the following report:

> A brigade of the enemy left from opposite the upper crossing fifteen minutes since, and crossed Deep Run, and is now moving to the right toward Banks' Ford. They have since disappeared from opposite our extreme left, below the lower crossing.[67]

Half an hour later Lowe signalled that the troops previously sighted had taken the Plank road. At 4:15 p.m. Lowe related, "The enemy have entirely withdrawn their advance line, with the exception of a small picket force."[68]

Lowe captured the withdrawal of Early's forces in his report. At the same time Lowe made his initial observation of the Confederate departure, Gibbon reported the same information to Butterfield, "Reports from my picket line on the right state that the rebels are withdrawing their pickets all along the river above the dam."[69]

Lowe's final report for the day at 5:30 p.m. summed up the Confederate withdrawal:

> Nearly all of the enemy's force have been withdrawn from the opposite side. I can only see a small force in the neighborhood of their earth-works. I cannot at this time get a sufficient elevation to tell what roads they take, but should judge by the appearance of army wagons moving to the right that the troops are moving that way also.[90]

A half hour after Lowe's final report on the 2nd, Jackson's attack began on the Union right flank. Despite the warnings, Howard's troops were ill prepared. Darkness which descended two hours after the attack began was more responsible for stopping this advance than Union troops. While returning to his own lines in the woods during this period of confused twilight, Jackson was shot by Confederate troops and removed from the battle.[91]

The Union left wing under Sedgwick had only one division south of the Rappahannock at sunset when he ordered his remaining 2 divisions to cross the river. Brook's division pushed forward to capture the River road. Sedgwick's intention was to push south along this road in the direction of Hamilton's Crossing. Butterfield and Hooker, driven by the reports indicating a complete enemy withdrawal, intended for Sedgwick to push through the Confederate positions at Fredericksburg and attack into Lee's rear at Chancellorsville by dawn. At 10 p.m. Butterfield transmitted his orders to Sedgwick, who was postured to move south, take Fredericksburg and then proceed

west to Chancellorsville and Lee's army. Sedgwick received the order at 11 p.m., reoriented his corps to move north and proceeded to Fredericksburg, which he reached about 2 a.m.[92]

Lowe made his initial report on 3 May, at 5:15 a.m. in which he reported the return of the enemy to their defensive positions opposite Sedgwick, and that they numbered less than yesterday morning. These troops that Lowe reported were Early's men returning to their original positions. At 6 a.m. an aide informed Lowe that the general desired to know the strong and weak points of the enemy line around Fredericksburg. Lowe responded at 7:15 a.m.: "The enemy's infantry is very light along the whole line opposite here, and especially immediately in the rear of Fredericksburg. I see no troops moving this way on any of the roads."[93] This report was Lowe's final for the 3rd that can be found in the Official Records, though Lowe described the attack in a paragraph following the last report as if he observed it firsthand. On the 4th, when asked by Hooker to put a balloon at U.S. Ford, Lowe replied he had one at Banks' Ford and the other at Fredericksburg, possibly indicating he had moved the balloon from the Phillips' House, though I cannot find a description of the new location.[94]

At 11 a.m. Sedgwick's troops stormed and took the heights behind Fredericksburg with a 2:1 advantage in troops

along the line, and closer to 8:1 at the point of attack.[95] Newton's division advanced 2 miles to the west of Fredericksburg, but was not joined by Sedgwick's remaining two divisions until 2 p.m.[96]

At Chancellorsville, Stuart, commanding Jackson's corps, and Anderson had achieved a link by 10 a.m. and driven Hooker's army from the field.[97] Shortly after 11 a.m. Lee received word that Early had been driven from Marye's Heights. At this natural pause in the battle, Lee elected to send McLaws and one brigade from Anderson's division to reinforce Wilcox's brigade at Salem Church. They arrived about 2 p.m.[98]

The battle of Salem Church began at about 3:30 p.m. when Sedgwick's column led by General Brooks advanced upon Wilcox's position. Brooks' division enjoyed initial success, but was eventually repulsed by Wilcox's reserve, the 9th Alabama, who chased the broken ranks a mile to the rear about 6:30 p.m. Darkness fell over the battlefield closing out the day's operations for 3 May.[99]

This day marked the first major hole in the coverage of balloon operations of this campaign. While no reports were available after 7:15 a.m., it is highly likely that the balloon at Banks' Ford was in operation, even though Lowe relocated his own balloon to Fredericksburg. Up to this point in the battle, Lowe's aeronauts provided valuable intelligence to the commander during each of the major

Confederate relocations that would be reasonably expected of them. On the 3rd no reports were available to document the retreat of Early's division after its defeat on Marye's Heights nor the reinforcements from the direction of Chancellorsville.

On the morning of the 4th, Early, having reorganized his division, moved forward on the Telegraph road and recaptured the heights, thus placing himself between Gibbon in Fredericksburg and Sedgwick, with his three remaining divisions 3 miles to the west. Anderson moved east from a position on Hooker's left flank to join McLaws at Salem Church by 11 a.m. Early's, McLaws' and Anderson's divisions totalling 23,000 men faced Sedgwick's command of 19,000.[100]

By 11 a.m. Sedgwick, confused and thinking Early's troops were fresh reinforcements from Richmond, wrote Hooker that if he could hold on until nightfall he would retire across the river at Banks' Ford. Hooker responded by urging Sedgwick to maintain a position on the south side of the Rappahannock if at all possible.[101]

Lowe's first report of the 4th at 12 noon confirmed the Confederate takeover of Fredericksburg and included an estimate of the enemy to be at least 15,000 men then in sight. Though the estimate was low, it was a much better estimate than Sedgwick's guess that he faced 40,000 men. Shortly after this ascent, Hooker, through his Assistant Adjutant-General, General Williams, requested a balloon at

U.S. Ford to which Lowe responded that the balloons were already optimally placed to observe the enemy's movements at Fredericksburg and Banks' Ford. Hooker rescinded his request.[102] Since the only enemy movement of the day occurred against Sedgwick's forces, Lowe's advice was correct because the terrain around U.S. Ford was heavily forrested and a balloonist operating there would have been blind to movements on the ground. However, the campfire intelligence that night might have shown Hooker the limited number of troops opposite him and possibly induced him to either attack or remain in his fortified position beyond the 6th of May.

Lee assumed command of the forces facing Sedgwick about noon. With his directions executed by 5:30 p.m., Lee signalled for the attack of the Union positions.[103]

At 6:15 p.m. Lowe reported to Sedgwick and Hooker, "The enemy are advancing in large force to attack our forces on the right of Fredericksburg."[104] As he was not trained in the language of the army, his skill at describing maneuvers left much to be desired. In this case, the volume of fire and the direction from which it came provided Sedgwick with the same information, although it may have been news to Hooker, five miles to the west.

At 6:50 p.m. and again at 7:30 Lowe reported that the Confederates were driving Howe's division badly and that they had taken control of the ground opposite Falmouth. A

fog settled over the battlefield shortly thereafter. These were Lowe's final reports for the 4th of May.[105] Despite the lack of balloon reports, no major Confederate movements took place.

Hooker remained safe in his defensive position waiting for Stuart to attack all that day, though he outnumbered the latter by a margin of 3:1. Sedgwick, under the cover of night and fog, withdrew his corps across the Rappahannock at Banks' Ford. Hooker, after meeting with his corps commanders, elected at midnight to withdraw the following evening.[106]

Lee consolidated his army on the 5th in preparation for an attack against Hooker's fortified position late in the day. Time ran out at 2 p.m. when a heavy rain began which continued until late in the evening and on into the next day as neither McLaws nor Anderson were in position for an attack before the rain began.[107]

Hooker's army began its crossing at 7:30 p.m. on the night of the 5th. Within three hours the river suddenly rose due to the rain and threatened to destroy the 3 bridges established for the crossing.[108] By morning of the 6th, Hooker's army was back on the north side of the Rappahannock and with it, Hooker's Chancellorsville campaign drew to a close.

Lowe's final recorded report of the Civil War was made at 10:45 a.m. on 5 May 1863, to General Butterfield

(Fog probably prevented an earlier start.). The aeronaut stated no significant movement occurred along the enemy's side of the river excepting for an occasional wagon, and that the enemy occupied in force all the terrain that they captured the day before.[109] Lowe made no mention of Anderson's and McLaws' movement out to the west even though they should have been visible. The Acting Chief Signal Officer, Samuel Cushing, indicated that a furious storm occurred at 2 p.m. on the 5th, which tore down telegraph poles and lines.[110] Perhaps heavy winds preceeded this storm which precluded an ascent.

With the drawdown of external conflict between armies, the chief aeronaut still needed to resolve his internal dispute with Captain Comstock. Professor Lowe, unwilling to work with the current organization, confronted the captain after the battle. To Lowe's surprise, the chain of command supported Comstock. The aeronaut immediately requested to be relieved and the captain agreed, inferring that now was as good a time as any.[111]

## Summary

An analysis of balloon operations during the Chancellorsville campaign examines the following five catagories: operational considerations, accuracy of balloon reports, timeliness, logistics, and usefulness.

The operational considerations which affected how balloons were used during the campaign included light,

weather, and terrain. Figure 10 illustrates their impact on the balloonists' ability to report movement.

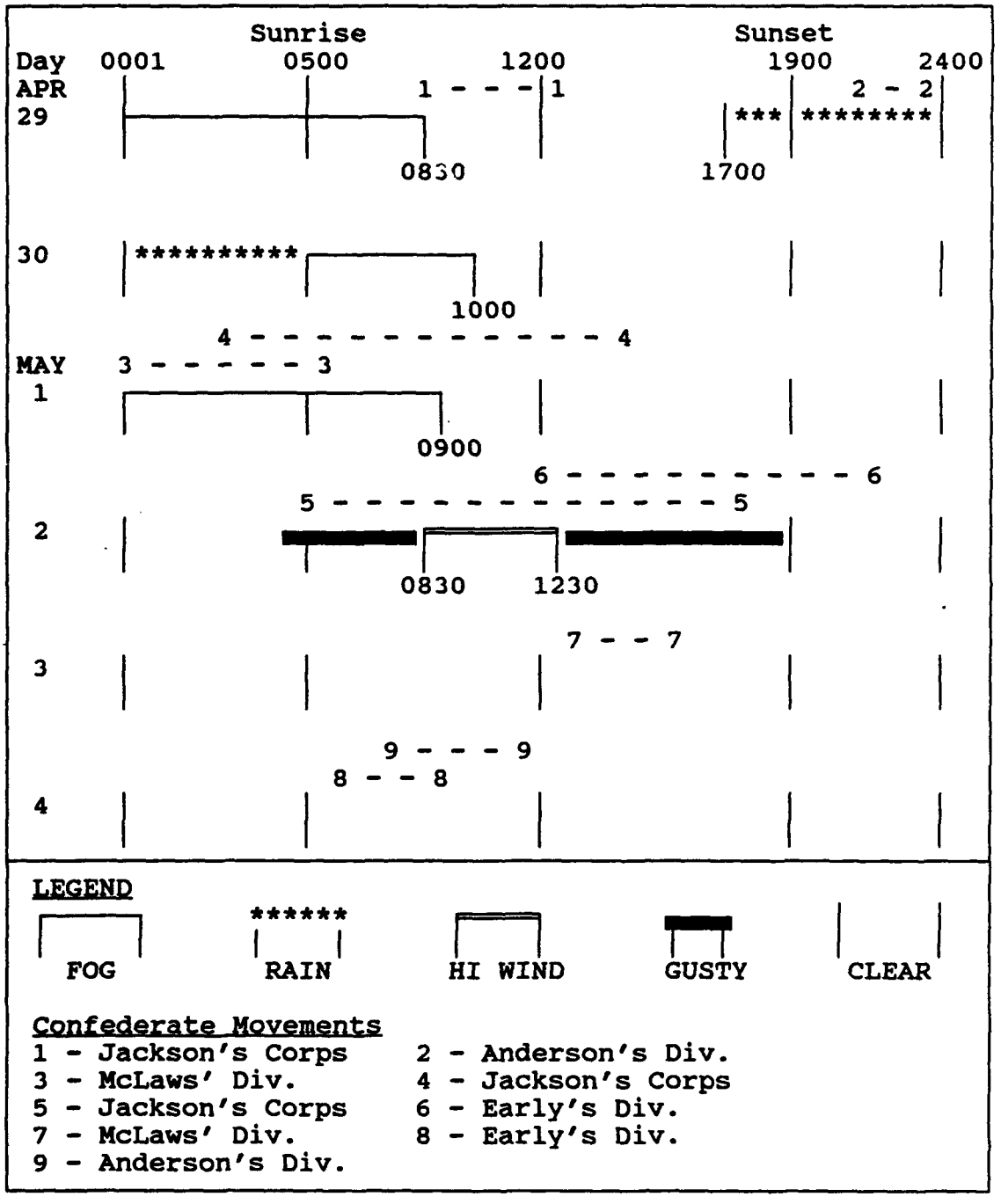


**Figure 10.** Impact of weather on observation

As illustrated in Figure 10, the initial Confederate moves to the west were made under the cover of darkness. Weather in the form of fog, low clouds, rain, and wind denied the aeronaut a view of the enemy as well. Finally, the trees and hills combined to shape the aeronauts' view of the landscape.

The days are located down the left column. The time scale runs from left to right for 24 hours starting one minute after midnight. The weather restrictions to balloon observations, as recorded in the various unit reports of the Official Records, also run along the horizontal axis. Confederate troop movements are represented with numbers connected by dashes and are located above the weather.

The balloon reports fall into three catagories: static, maneuver, and engagement. The static phase, which involved locating enemy camps and estimating enemy strengths both day and night by campfire, occurred during the months leading up to the first Confederate movement of the campaign. Lowe's balloons reported 11 enemy camps by 17 April, which in fact there were; however, the aeronaut incorrectly perceived a camp near Todd's Tavern when actually it was located near U.S. Ford, ten miles to the northeast. Lowe's first recorded troop estimate was made on 22 April where he stated that the enemy numbered "three to our four". Furthermore, he estimated 35,000 troops to the west of the rail line, while counting in excess of 10

regiments on parade near camps east of the line. Lowe was reporting on 65 percent of the available Confederate strength and had located 10 out of 11 of their winter camps. This information, verified by the other available sources, provided an accurate picture of the enemy disposition. It was certainly much better than that which McClellan claimed during the Peninsular campaign, since Hooker knew he outnumbered his opponent.

The maneuver phase involved the relocation of Confederate brigade size or larger units starting on 29 April. The successful detection of maneuvering units by the balloonist required good visibilty during daylight hours in addition to the enemy troops in plain view. Referring to Figure 10 and from the balloon reports available through 2 May, four of six Confederate movements took place during favorable conditions. Jackson's flank march was the only one missed, but would have been visible on a calm day. The balloonists were the sole supplier of reports concerning Jackson's relocation on the 1st, though the missing units south of Sedgwick's crossings would surely have been noticed eventually by signal stations. On the 4th, Lowe reported Early's troops retaking the heights, while no reports documented Anderson's movement from the Wilderness to the vicinity of Salem Church. That same day, Lowe reported the enemy in view near Sedgwick to number 15,000, which was much closer to the actual 23,000 than the 40,000 estimate then

believed by Sedgwick, though with Lowe on the opposite side of both the Confederate lines and the river it is doubtful Sedgwick ever knew of the aeronaut's estimate. All told, the balloonists reported four of seven marches. Two of the three remaining marches went either unreported or reports are not contained in the Official Records. Overall, Hooker and Butterfield were aware of Lee's maneuvers in a large part due to their use of balloons. Hooker simply failed to act in too many cases.

The weakest aspect of the Union balloon effort fell in the engagement phase. At the first hint of battle out west on the 1st, Lowe invited a staff officer to ascend. The distance was great, the action obscurred by smoke and trees, and Lowe lacked the background and vernacular to effectively describe what he saw, given the limitations of the communication network available. One bright spot for Lowe was the request by Butterfield on the 3rd for the aeronaut to locate the strong and weak points in the trenches behind Fredericksburg. It is doubtful that the information was used by Sedgwick since his division commanders were on the south side of the river and already maneuvering for the attack, although this information was transmitted to Butterfield and Sedgwick at 7:15 a.m. At least Butterfield was comforted enough to press Sedgwick forward to Hooker's aid. The final instance of tactical reporting occurred at 6 p.m. on the 4th. Lowe's report

focused on the advance of Early's troops towards Falmouth and ignored the fighting on the remainder of the battlefield. However, these reports shared nothing that the commander on the ground did not already know by the noise of the battle.

Hooker's command and control system was well organized and centralized, yet limited by its communications capability which decreased the timeliness and effectiveness of the balloon reports. Hooker organized the Army of the Potomac into two wings, the right under his control, the left under Sedgwick's. Between the two wings, at Falmouth, Butterfield was to provide the connectivity via the communication network while maintaining the tactical picture using the recently created Military Information personnel under the direction of Colonel Sharpe. This intelligence cell was the first of its kind in the Civil War.

Sharpe's people not only organized the spies and scouts but probably the balloon locations and initial placement of signal stations for the campaign as well. Captain Cushing wrote in his after action report that the initial line of stations had already been established to observe the Confederate positions. Lowe was directed on 7 April to locate camps on the topographical maps provided. The balloon locations at White Oak Church and Phillips' House provided optimum coverage of the winter camps. The aeronaut was also directed by Hooker to move the balloons to

a specific location, that being Banks' Ford, and look for enemy strengths between Bowling Green, Fredericksburg, and the balloon. This specific tasking for Lowe indicates someone (probably Sharpe) was looking at a map and directing the optimum placement in order to observe the open terrain and roads leading west to Chancellorsville. The balloons and signal stations were connected to Sharpe's cell via telegraph and signal flag. Unfortunately for Hooker, the balloons were unable to extend the battlefield for him into the Wilderness off the road network thanks to the tree coverage, as already stated, in excess of 75 percent.

Hooker's communication network between the two wings was provided by messenger, telegraph, and signal station. I can find no reports that indicate Lowe's balloons were used for signalling.

Hooker's exterior lines significantly degraded his ability to respond to balloon reports, or any other information provided by the left wing. While these lines were shortened on the 29th and 30th across U.S. Ford with the establishment of signal and telegraph stations, Hooker was unsuccessful in coordinating attacks and demonstrations using his left wing. Hooker's confusion in orchestrating the efforts of his 130,000 man army was compounded by the delays imposed by a single strand of telegraph wire, in parallel with signal flags, backed up by messengers, that were hours late. An example of this problem was Hooker's

order transmitted at 11 a.m. on the 1st, which required Sedgwick to threaten an attack at 1 p.m. Sedgwick did not receive the order until sunset that evening.

This failure on the Union side was in sharp contrast to the Confederate experience. Lee, upon receiving the report of the fall of Marye's Heights, had a division in position at Salem Church to defend against Sedgwick's Corps within four hours despite the requirement to disengage from Hooker's forces in the west and march several miles. Lee's ability to accomplish this event was facilitated by interior lines of communication and his face-to-face order to McLaws.

Hooker placed the Balloon Corps under Captain Comstock when he issued Special Order Number 95, which reorganized his army. This change had no operational impact during the campaign as far as I can tell. Lowe, by default, ran the organization as before, using the telegraph and signal stations near his balloons to communicate with headquarters.

Logistic support for the balloons flowed via the water network to Aquia Creek Station Landing and then overland to the balloon camps. Two of four balloons available were sent back to Washington for repairs prior to the campaign, which left the smallest two balloons for the operation. Consequently, they required less hydrogen to ascend and fewer men to guide the ropes. According to Lowe, they were the best suited for operating in high winds as

well. The balloonists responded well to the damands of the campaign by relocating from White Oak Church to Banks' Ford on the night of the 29th without missing an opportunity to go aloft. Overall, balloon operations were free of logistic constraints and able to support the commander's tasking.

The balloons provided useful information to General Hooker during two critical phases of the campaign. In the first instance, Hooker knew that Lee held onto his defensive positions while the Union turning movement unfolded. Second, when Lee finally maneuvered Jackson's Corps on the 1st, Hooker was again aware thanks to the balloon reports which were provided prior to the initial contact of the opposing armies.

All in all, the balloons operated unimpaired by logistics, and, in spite of poor weather, provided Hooker's army with useful and accurate information. Timeliness of reported information, coupled with the essential response by Hooker nullified balloon effectiveness.

# CHAPTER 6

# CONCLUSION

Thaddeus S.C. Lowe left the balloon corps on 7 May 1863. His former organization was sent to Washington as the Union army followed Lee north into Maryland. The balloon corps never saw active service again during the Civil War.[1]

Many people point to this organizational collapse as indicative of the service rendered by these American military balloonists. The claim could not be further from the truth. The demise resulted from the departure of the project's sole organizer, Thaddeus Lowe. With him went the corporate knowledge of the organization behind military ballooning in the Union army. But, how effective was this organization from a military perspective in the periods available for study?

The timeliness of balloon reports saw steady improvement throughout the conflict. McClellan's ability to respond to Confederate activity during the defensive phase in front of Washington was never tested. While on the Peninsula, the balloons experienced their first limited tactical success. The innovative balloon use by General Stoneman for scouting with his advance guard during the advance on Richmond enabled him to outperform the

Confederate defenders. McClellan enjoyed no such luck on a much grander scale when the maneuver forces consisted of division size forces. Stoneman's willingness to ascend in the balloon car with Lowe during tactical activity proved to be a noteworthy distinction. This posturing facilitated the timeliness of his unit's response as he directed both artillery fire and infantry units via telegraph. By contrast, McClellan waited at headquarters for the balloonists to transmit reports thereby adding precious time to his ability to respond. The following spring during the Chancellorsville campaign a well orchestrated balloon effort provided Lee's tactical maneuvers to Hooker before the ground forces made contact.

Despite Confederate deception efforts, Lowe's aeronauts routinely provided accurate information to the commander. Many Union generals, including Hooker, endorsed the gas bags only after witnessing extended use during that first winter stalemate. On the Peninsula, balloonists provided detailed information of enemy fortifications, confirmed the Confederate withdrawal from Yorktown, and reported the massing of enemy forces prior to the Battle of Fair Oaks on 29 May 1862. Hooker's knowledge of Confederate strength and locations as he began his fateful maneuver was almost complete thanks to the efforts of Lowe and his assistants. This clear tactical picture continued throughout Hooker's maneuver until Jackson counterattacked

under Lee's direction on 1 May when the forests of the wilderness precluded further observation of the Confederates fighting from there.

The usefulness of balloon information matured throughout the war. During the first winter, the balloons provided meaningful security to McClellan's army while it trained for the coming spring campaign. On the Peninsula, while McClellan's siege warfare had been criticized, the balloons provided the engineers, mapmakers, and generals a unique vantage point from which to view the static Confederate defenses at Yorktown and again in front of Richmond. During the defining moments of the campaign at Seven Pines and again at Gaines' Mill, the aeronauts provided advanced information to McClellan concerning the massing of enemy troops, but failed to influence the course of these two battles once they began. However, at Chancellorsville, Lowe's balloons performed at a level that should have decided the campaign and quite possibly the Civil War, but Hooker acted too cautiously with the information provided once he moved south of the Rappahanock.

Trees, wind, and restrictions to visibility plagued the balloon operations equally in front of Washington, on the Peninsula, and around Fredericksburg. As early as the fall of 1861, Lowe altered his balloon design in order to facilitate operations in higher wind conditions. Aside from this modest improvement to balloon availability, operational

considerations and their impact on balloon observation remained constant throughout the war.

Logistical problems associated with balloon operations decreased as the aeronauts gained experience. A slow initial resupply effort by Lowe caused delays for Hooker at Budd's Ferry. Balloon operations during McClellan's advance up the Peninsula went smoothly for Lowe, but the lack of transport during the retreat caused him to lose his iron filings which, in turn, precluded any further ascents until another camp was established at Harrison's Landing. Thus Lowe's balloons missed all but the first two days of the Seven Days' Battle. Haydon pointed out that for lack of transport prior to the battle of Antietam, the Union balloons were unavailable for service.[2] On a more positive note, the balloons at Fredericksburg and Chancellorsville were never grounded for want of supplies as the one relocation to Banks Ford during the latter campaign occurred at night with no mishaps and it was back in operation before sunrise.

In terms of combat power, the balloons noticeably improved Union operations as the war progressed. Initially they supported the Union defensive efforts in front of Washington through the provision of security to the army. During McClellan's advance up the Peninsula, the van of his army repeatedly incorporated the advantages of balloons to provide tactical success. Stoneman directed the maneuvers

of his force all the while orchestrating the indirect fires of his artillery in their support as well. Finally, the command and control cell under General Butterfield enhanced the information available to Hooker in the Chancellorsville Campaign unfortunately the campaign's outcome overshadowed this success.

On the Confederate side, manned balloons saw effective service only on the Peninsula, and those efforts, while providing useful information, did not go so far as to influence Lee during any of the tactical engagements. Limited access to silk and other specialized items precluded balloon observation to their commander despite the usefulness of the device as was so often proclaimed by their leadership to include General Longstreet. It would be difficult to assess the Confederate balloon effort as successful in light of their limited service.

Plagued by growing pains in the early stages of the war, Union balloon operations eventually blossomed into a valuable tool for the commander despite the limitations imposed by weather and trees. Unfortunately, the loss of both Lowe and his father at the tight fisted hands of Captain Comstock proved a crippling blow to the organization as it disbanded shortly after their departure.

War has been described as both a science and an art. While the scientific aspect of ballooning, which includes both military effectiveness and combat power, was a success,

the artistic side reveals the failure of the organization to survive beyond Chancellorsville.

Lowe's absence from the organization removed the one person uniquely qualified to both illuminate and demonstrate the merits of ballooning to Hooker's replacement. Through his previous efforts to cross the Atlantic, Lowe gained the necessary technical skills to both build and operate a balloon organization that would withstand the rigors of military operations. Lowe, using his showman skills, initially earned an opportunity via the President to prove his observation concept to the army leadership. Ultimately, however, Lowe's ability to articulate the merits of his system to the generals, and then successfully demonstrate it, proved to be the critical link that marked his operation as a success. Like the aeronauts sent to other theaters, and the Allen's who remained in the balloon corps after the Lowes, none proved capable of bridging this critical gap to support the commander's needs.

A reluctant mindset of some senior military leadership to recognize and incorporate this new technology represents another contributor to the demise of the balloon corps. At this point in American military history, ballooning represented something new to an army steeped in the Jominian traditions flowing from the Napoleonic Era. Not all of the leadership accepted the device when it was thrust into their laps despite assurances from McClellan.

La Mountain's rebuff upon his return to Fortress Monroe in 1861, and Steiner's disappointing experience with General Pope in the western theater are but two examples, while Starkweather's setback in Port Royal, South Carolina, represents a third. As Haydon pointed out, General Thomas W. Sherman, the expedition commander, directed Starkweather to wait for orders to ascend, but those orders were not issued until over three months had elapsed, and Sherman was replaced.[3] The lack of continuity between Hooker, the last senior leader with balloon experience, and his replacement shortly after the Lowes' departure also contributed to the demise.

Haydon expands on the theme of poor administration as the last significant contributor to the collapse of the balloon corps. While administration was a major problem in the Civil War, the vast majority of the shortcomings uncovered by the author have been corrected through the use of the army's Force Developement process. But what other implications carry forward to today?

Personality, the commander's influence, and battle command all have relevance in the modern arena, as they did during the Civil War. This issue of personality influences the modern scenario in two ways. First, the military still goes to war with critical positions filled by civilians such as Lowe that possess specialized information concerning a single weapon system. These technical representatives have

the potential to stop the show through their absence if demands prove too great. Imagine the repercussions within the military if the avionics representatives failed to muster for Desert Storm.

The second aspect of personality deals with the procurement system. While personality determined success in the Civil War, the current acquisition process ensures more of an institutional product weighted by the commanders' experience. Driven by doctrinal concepts or stated requirements, the institution surveys industry for a nondevelopmental item (NDI), and in the absence of any, writes a specification to be filled by the private sector. A more timely alternative occurs when an independent contractor submits a device to the system for consideration, much like the aeronauts of the Civil War. Recent examples of the latter include the Small Lightweight User Global positioning system Receiver (SLUGR) and the Fiber Optic Guided Missile (FOGM). Thus, the process ensures the requirements of the commander are met, and yet retains the flexibility to pick and choose from the shelf. In a time of rapidly changing doctrine, which in turn, is driven by the dynamics of a tumbled wall, the acquisition system has dramatically improved from the Civil War days.

The commander's mindset, as in the days of Lowe, can still adversely influence the incorporation of new technology into his command. While the introduction of

computers into a unit should save time, many filling the leadership role insist on either butcher paper or hand-written solutions. Or, how about the commander who insists on using hand generated map overlays during the Intelligence Preparation of the Battlefield (IPB) process when digital terrain products and multi-spectral imagery are available? Does the military still limit the reception process by inadequately preparing both the commander and his staff?

Illuminated by the defeat of the Union army at Chancellorsville, the concept of battle command generates another lesson for today. Hooker, in addition to cavalry, spies, signal officers, deserters, and subordinate commanders, had to contend with information from civilian aeronauts floating above the battlefield. Chancellorsville represents the first point in American history in which the commander could piece together available information to include that from the sky and act decisively to achieve victory. In this case the synthesis of information proved inadequate. Thus, despite available information, the commander's mind limited the outcome to defeat.

While in Hooker's day the balloons were new, advanced surveillance equipment linked to the command cell by a complex network of computers and radios accurately describe the challenges of the modern environment. Are commanders trained to act in this environment today given the explosion of information currently available?

From a tactical perspective where battles are fought and won, the final and most striking lesson lies in understanding the limitations imposed by new technology. For Civil War balloons, trees, wind, and weather provided insurmountable obstacles to optical surveillance. As we move into another generation of surveillance mounted on the aircraft of the 90s, not only is it important for the commander to understand what can be seen, but equally important, what cannot.

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## APPENDIX A

## WIND EFFECTS

In order to appreciate the impact of wind on the balloon, it is necessary to recognize all of the forces which act upon it. Those forces are the wind, gravity, buoyancy, and tension and are depicted in Figure 11.

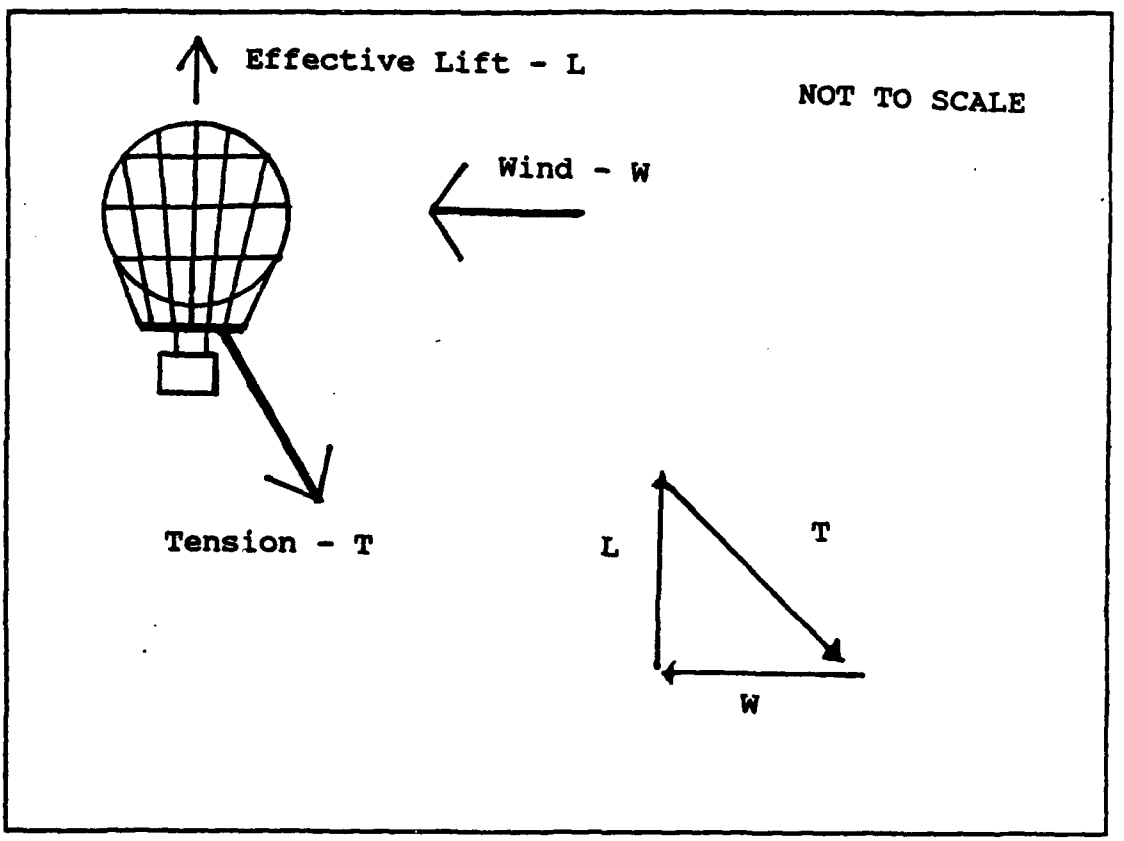


**Figure 11.** Impact of wind on balloon operations

The wind vector, W, represents the cumulative effect of the wind acting on the balloon envelope. The wind vector physically represents the pressure induced on the balloon envelope by the wind acting over the surface area of the spherical envelope. The normal component of the balloon surface with respect to the horizontal wind can be represented by a circle of the same diameter of the sphere. Thus a 30 foot (9.14 meter) diameter balloon has a normal surface of 65.6 square meters. This approximation assumes a large envelope size in comparison to that of the balloon car where the latter contributes such a small portion to the wind vector, W, that it can be ignored.

The remaining three forces, unlike the wind, are always in play on the balloon aloft. The net lift, L, symbolizes the buoyant force generated by the use of hydrogen in the envelope counteracted by the gravitational force or weight of the balloon, the tension wires, and its passengers. The guide wire tension, T, represents that force that is necessary to hold the balloon in a stationary position from the ground. This tension counterbalances the excess buoyant force as well as the wind to hold the balloon stationary.

The vertical force or net lift acting on the balloon can be figured as follows. The weight of the silk balloon envelope, cordage, and wicker basket for the smallest balloon of 15,000 cubic foot capacity (used throughout this

analysis) are estimated as 175 pounds from Haydon's description of components (see Chapter VII of Aeronautics in the Union and Confederate Armies). The weight of one occupant together with his equipment totaled another 175 pounds, therefore the net weight acting to restrain the buoyant lift is 350 pounds. The difference in density between hydrogen and the displaced air when multiplied by the volume of the envelope yields the mass of the displaced air which when acted on by gravity yields the lifting or buoyant force. The sea level density of air is 1.22 kilograms per cubic meter (kg/cu m), while that of hydrogen is only 0.08988 kg/cu m. The difference between the two is 1.13 kg/cu m. A 15,000 cubic foot or 425 cubic meter envelope full of hydrogen displaces 480 kg of air which when acted upon by the acceleration of gravity, 9.8 meters/square second, yields 4704 Newtons or 1058 pounds of lift. Therefore the net lift deducts the weight of the balloon and occupants from the buoyant force resulting in 708 pounds of force acting vertically upward (Use of the metric system eliminates the confusion of converting from pounds force to pounds mass in the english system of units).

The force of the wind acting horizontally on the balloon envelope can be computed as follows. The net horizontal force acting on the balloon can be viewed as a pressure differential generated by the wind acting over the surface area of the balloon envelope. The pressure equals

one half of the density of air multiplied by the square of the wind velocity, while the cross sectional area for a spherical 15,000 cubic foot balloon is 707 square feet (65.6 square meters). Using this pressure-area relationship for the horizontal wind force, and if we know the wind force required to suspend the balloon at say a 45 or even 80 degree angle from the vertical, no-wind position of the balloon, then calculation of the wind speed becomes possible.

Summarizing at this point, we know the vertical force or net lift acting on the balloon, and we know the pressure-area relationship for the horizontal wind force. We must now focus on the tension wire force that holds the balloon in equilibrium during steady wind conditions.

Since the solution assumes a steady wind and the balloon in equilibrium under the combined effects of wind, gravity, buoyancy, and tension, then for a given wind condition, the tension varies as necessary to compensate for both the net lift or vertical force, and wind or horizontal force. Additionaly, since the vector sum of the vertical, horizontal, and tension force must equal zero for an equilibrium solution, then by fixing the net lift force, L, at 708 pounds as estimated earlier, the balloon's angle of inclination is only a function of wind force, W. By fixing the wind force, wind velocity can be converted using the pressure-area relationship.

As an example, a balloon inclined 45 degrees from the vertical has an equal vertical and horizontal force acting upon it, which in turn, is held in equilibrium by the tension wire. Therefore, a balloon with a net lift of 708 pounds inclined at 45 degrees requires a wind force of 708 pounds to hold it in equilibrium. Using the pressure-area relationship described earlier, converts this wind force into a wind speed of 19.9 miles per hour (mph).

As a final example, a wind force that were 10 times the net lift force would incline the balloon 84 degrees from the vertical or only 6 degrees above the horizon. This condition approximates those experiences by Lowe when the balloon was nearly blown to the ground. W now equals 7080 pounds and converts to a wind velocity of 62.9 mph.

## APPENDIX B

## LITERATURE NOTES

War of the Rebellion: Official Records of the Union and Confederate Armies, provided the primary source material for the entire thesis. Specifically, Series III, Volume 3, Union Correspondence, contains those portions of Lowe's letters submitted for historical purposes. There are many gaps in this coverage as Lowe submitted only those documents that he found illustrative of the balloon efforts. Supplementing these writings, but unavailable in Kansas, are those available in the Library of Congress, Manuscript Division, AIAA History Collection, boxes 80-84. In addition to Lowe's correspondence, battle reports from the two campaigns enabled verification of Lowe's statements as well as those of other authors. These included, I 11 I The Peninsular Campaign, and I 25 I The Chancellorsville Campaign. Very little in the way of balloons or aeronauts found its way into the official reports of either side.

Well organized background material for the balloon topic were found in three works. F. Stansbury Haydon's Aeronautics in the Union and Confederate Armies, represents by far the best source on the Civil War balloon topic. Tom D. Crouch's work, The Eagle Aloft, contains two great

chapters covering the men and their Civil War operations. Finally, Charles Harvard Gibbs-Smith's work, A History of Flying, rounds out the readable works that extensively cover the topic.

While the Confederate balloon operations were sparsely covered, the most comprehensive work that encompasses many of the other sources, The air arm of the Confederacy, written by Joseph Jenkins Cornish III. John Randolph Bryan's personal account of his Confederate balloon operations can be found in "Balloons used for scout duty in C.S.A.," Southern Historical Society Papers. Finally, Langdon Cheves Jr. documented the construction of a Confederate balloon in, "Captain Langdon Cheves, Jr., and the Confederate Silk Dress Balloon," which was edited by J.H. Easterby in the South Carolina Historical Magazine.

The primary background material for the two campaigns were John Bigelow's, The Campaign of Chancellorsville, and Stephen W. Sears', To the Gates of Richmond: The Peninsula Campaign. Bigelow's work proved to be the easiest to use in terms of cross referencing balloon reports with the Official Records.

The following articles provided additional background information. William Alexander Glassford's, "The balloon in the Civil war," Journal of the Military Service Institution of the United States, added anecdotal material. Capt. Daniel T. Davis', "The Air Role in the War between the

States: The Civil War Balloon Activities of Professor Lowe," found in Air University Review, presented an overview of Lowe's Civil War operations. Thaddeus Lowe in, "The Army Takes to the Air: A Balloonist's Autobiography," covered in Civil War Times, prov. e background information.

The following articles provided unique perspectives with which to incorporate. Weaving other personalities into the historical fabric, Dr. Lawrence A. Frost wrote, "Balloons over the Peninsula: Fitz John Porter and George Custer become reluctant Aeronauts." written in Blue and Gray Magazine. While Herman Hattaway in his "Balloons: America's first Air Force," in American History Illustrated, added some helpful comments concerning Confederate deception as did June Robinson's "The United States Balloon Corps in action in Northern Virginia during the Civil War," printed in The Arlington Historical Magazine. Warren W. Hassler's work "The Winds of Chancellorsville," written in Civil War Times, covered the impact of weather on balloon operations. Finally, Jay Luvaas highlighted Hooker's tactical advantage with regards to balloons in his article, "The Role of Intelligence in the Chancellorsville Campaign, April-May, 1863." published in Intelligence and National Security.

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